SCIENCE

VOL. 78 FRIDAY, DECEMBER 8, 1933 No. 2032

The National Academy of Sciences:
Address of Welcome: DR. KARL T. COMPTON 515
Papers Presented at the Cambridge Meeting 518
Scientific Events:
Construction at the Beltsville Experiment Station; Experiments on the Prevention of Soil Erosion; The Morris Foundation Fellowships; The Texas Academy of Science; Officers of the American Society of Tropical Medicine; Award of the Townsend Harris Medals of the College of the City of New York 525
Scientific Notes and News 528
Discussion:
Wide-spread Errors relating to Laplace: PROFESSOR G. A. MILLER. *Propagation of Hybrid Amaryllis by Cuttage:* DR. HAMILTON P. TRAUB. *Suggested Nomenclature for Heavy Hydrogen and its Compounds:* PROFESSOR R. W. WOOD 531
Special Correspondence:
Health Problems in the Amazon Valley: DR. ROBERT J. NEEDLES 532
Scientific Books:
The Life and Work of Professor William Henry Perkin: DR. BENJAMIN HARROW 534
Scientific Apparatus and Laboratory Methods:
A Simple Sensitive Thermostat Regulator: DR. CHAS. E. WOODWORTH. *Using a "Dry" Microscope Objective on Uncovered Objects:* PROFESSOR F. C. SAUER 535
Special Articles:
The Internal Exposed Surface of Foliage Leaves: FRANKLIN M. TURRELL. *Predominant Strain of B. influenzae in Influenzal Meningitis:* DR. OLGA R. POVITZKY. *Selective Fertilization and Sex-determination in Hymenoptera:* DR. P. W. WHITING 536
Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE NATIONAL ACADEMY OF SCIENCES

ADDRESS OF WELCOME[1]

By Dr. KARL T. COMPTON

PRESIDENT OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

IT is no common honor and privilege which I have this morning in welcoming the most distinguished scientific body of America to Cambridge as the guests of the Massachusetts Institute of Technology. Pleasant and stimulating as these meetings are, and appropriate as is this old New England center of intellectual progress for meetings of this type, it is natural that the academy can meet in the Boston region only at intervals of a number of years; and when it does meet in this region, the Massachusetts Institute of Technology will have to take its turn with its sister institution up the river in the privilege of acting as host. While on this particular occasion you have done us the honor of accepting our invitation, I wish to emphasize the fact that in a very real way Harvard University is also your host, since several Harvard members of the academy have cooperated as members of our local committee and are participating in the entertainment of our guests. I wish, therefore, to speak not only for the Massachusetts Institute of Technology, but also for the entire academy group in this region, in welcoming you to these meetings.

The mention of the cooperation of our Harvard colleagues on this occasion leads me to say a few words about an important aspect of the relations between our two institutions. Each has a position of eminence in its own field. At various points these fields of interest overlap. I do not believe that many people outside of these institutions realize the extent to which real cooperation between them is an accomplished fact, whereby graduate students and staff in the overlapping fields may take advantage of the special opportunities and facilities in both institutions. While each institution tries to do its own work in the most effective possible way, our ideal is to offer to the more advanced students the combined advantages of both institutions in so far as this is possible by cooperation.

[1] Address at the opening session, Massachusetts Institute of Technology, Cambridge, November 20, 1933.

I therefore extend this welcome to you in a sense as a representative of both institutions, although the Massachusetts Institute of Technology has undertaken the primary responsibility on this particular occasion.

It would be fitting on this occasion, I think, to review very briefly certain outstanding events in the history of the National Academy of Sciences, with particular reference to a new aspect of these activities which gives promise of further extending the prestige of the academy and its service to the public in a significant way.

When it is recalled that the charter of the National Academy of Sciences was given in the administration of President Lincoln and that that very active arm of the academy, the National Research Council, was created by executive order of President Wilson, it is evident that the significant steps in the organization of the academy have occurred during times of national emergency. It is this same principle which has applied in the creation of the Science Advisory Board as an agency of the National Academy and the National Research Council to assist the government during the present emergency.

The executive order of President Roosevelt, dated July 31, 1933, reads:

ESTABLISHMENT OF SCIENCE ADVISORY BOARD UNDER THE NATIONAL RESEARCH COUNCIL

The National Research Council was created at the request of President Wilson in 1916 and perpetuated by Executive Order No. 2859, signed by President Wilson on May 11, 1918. In order to carry out to the fullest extent the intent of the above Executive Order there is hereby created a Science Advisory Board with authority, acting through the machinery and under the jurisdiction of the National Academy of Sciences and the National Research Council, to appoint committees to deal with specific problems in the various departments.

The Science Advisory Board of the National Research Council will consist of the following members who are hereby appointed for a period of two years:

Karl T. Compton, *chairman*, president, Massachusetts Institute of Technology, Cambridge, Massachusetts.

W. W. Campbell, president, National Academy of Sciences, Washington, D. C.

Isaiah Bowman, chairman, National Research Council; director, American Geographical Society, New York City.

Gano Dunn, president, J. G. White Engineering Corporation, New York City.

Frank B. Jewett, vice-president, American Telephone and Telegraph Company; president, Bell Telephone Laboratories, Incorporated, New York City.

Charles F. Kettering, vice-president, General Motors Corporation; president, General Motors Research Corporation, Detroit, Michigan.

C. K. Leith, professor of geology, University of Wisconsin, Madison, Wisconsin.

John C. Merriam, president, Carnegie Institution of Washington, Washington, D. C.

R. A. Millikan, director, Norman Bridge Laboratory of Physics, and chairman of the Executive Council, California Institute of Technology, Pasadena, California.

FRANKLIN D. ROOSEVELT

The White House,
July 31, 1933.

(No. 6238)

Whatever may have been the arguments pro or con for setting up an organization of this type (and I can speak of this quite objectively, because I had no knowledge that any such step was even contemplated until the executive order had been published), the fact remains that the situation has developed in such a way that through this board the Academy and the National Research Council are being given an opportunity to assist the government to an extent which has never before been equalled in the history of the Academy, with the exception of the critical period during the last war. The reasons for this, I think, are twofold.

In the first place, the change of administration and the economic crisis of the country and the tremendous program upon which the government has embarked to pull us through this crisis have all raised an unusual number of problems which have important bearing on the organization and program of scientific work of the government or of agencies over which it has some jurisdiction. At the same time, the responsible officers of the government are burdened with such a load of added responsibilities in connection with the recovery program that they must of necessity look for expert advice on these problems. Our experience thus far has been that when this advice is sound and clear-cut, it is welcomed and acted upon as effectively as conditions permit.

In the second place, the basis of any assistance to the officers of the government must be absolute confidence of these officers in the competency and disinterestedness of the group offering the advice. I wish here to pay a tribute to the tact, resourcefulness and energy with which the new chairman of the National Research Council has dealt with the situation and has gained the personal confidence and respect of those government officers for whom these problems are being handled. In a reciprocal way I can bear witness in all sincerity to our conviction, based on contact with these government officers, that they are above all anxious to discharge their duties for the best interests of the country, without fear or favor.

Let me go on now to mention very briefly, by way of illustration, a few of the problems which the Science Advisory Board has undertaken during the past three months.

The Weather Bureau: The Secretary of Agriculture asked the Science Advisory Board to submit recommendations for improving the service of the Weather Bureau. To assemble the facts and formulate tentative recommendations for consideration by the board, a committee was formed, consisting of R. A. Millikan, *chairman,* Isaiah Bowman, Charles Dana Reed and Karl T. Compton. This committee called into consultation leading members of the staff of the Weather Bureau and of the meteorological services of the Army, the Navy, the California Institute of Technology and the Massachusetts Institute of Technology, and also technical experts attached to the Aeronautics Division of the Department of Commerce. It gave consideration to a recent report on the Weather Bureau by a committee of the American Society of Civil Engineers. It discussed its tentative proposals with high administrative officers of the Weather Bureau, the Department of Commerce, the Army and the Navy. As a result of these efforts the Science Advisory Board submitted last week to the Secretary of Agriculture a preliminary report on the service of the Weather Bureau, with recommendations for reorganizing this service in several important respects to take advantage of improved techniques and new opportunities for increasing the accuracy and probably the range of forecasting, and it was able to report that these recommendations have received the unanimous approval of all experts consulted and the agreement of the administrative officers in all departments of the government which are concerned, to cooperate in making the proposed reorganization successful and economical.

The United States Geological Survey and the Bureau of Mines: The Secretary of the Interior submitted to the Science Advisory Board several questions in regard to the organization of the U. S. Geological Survey, the Bureau of Mines and the Division of Mineral Resources of the Department of Foreign and Domestic Commerce. These matters were referred for study and tentative recommendations to a committee, consisting of Charles K. Leith, F. P. Beckett and Frank de Wolf. Because of the urgency of certain questions, this committee has submitted two preliminary reports and will soon be ready to submit its final report to the secretary. It is not going too far to say that the preliminary reports already submitted have done much to clarify and settle a peculiarly difficult problem which confronted these services, particularly in consideration of the greatly increased importance of these services in a planned economy in which accurate knowledge of minerals and mineral resources is necessary for intelligent planning.

The Railroads: At the request of the Federal Coordinator of Transportation, the Science Advisory Board has set up a committee on research for the railroads, comprising men who have had outstanding success as directors of industrial research laboratories or who have, in one way or another, a background which would make them of peculiar assistance to the railroads in the formulation of a plan which will more effectively bring science to the service of the railroads, in the interests of improved service to the public and an improvement in their financial situation. This committee consists of F. B. Jewett, *chairman,* Maurice Holland, director, C. F. Kettering, John Johnston, Francis Frary, E. K Bolton, A. A. Potter, Dugald C. Jackson, H. G. Moulton, of the Brookings Institution, and R. L. Lockwood, of the office of the Federal Coordinator. This committee is to cooperate with a committee of high railway executives to study the railway situation, formulate recommendations, and advise in putting the plans into effect.

Perhaps twenty other illustrations could be given of the work of specific committees or of cases in which a better coordination has been introduced into new activities of the government through the Science Advisory Board but time does not permit their enumeration.

There are, however, two further aspects of the work of the Science Advisory Board to which I would call particular attention, since these have to do not with the meeting of present problems or emergencies but with the formulation of permanent policies through which science and the government may better serve the public. One of these involves cooperation with representatives of the social sciences to insure joint action with them on the problems of the present emergency as well as of future policies, in order that actions may be taken with the best possible knowledge of all aspects and implications of the problems. The other involves the formulation of a permanent policy of the government with respect to scientific research. This is particularly important in this time of flux of policies and institutions. The discussions which centered around the word "technocracy" have raised some important problems but have at the same time unduly shaken public confidence in the basic services of science to society. It is important that the government's policy should not be in the direction of curtailing the development of science and its application to human welfare, but rather in the direction of coordinating these developments with the necessary social and economic adjustments in order that benefits may be made a maximum and the difficulties of readjustment be minimized. It is within the scope of the assignment of the Science Advisory Board to make positive recommendations to the President along these lines, and to this end two excellent committees have

been formed to give preliminary consideration to these more permanent aspects of the board's work, with the expectation that these should become the major responsibilities of the board as soon as the more pressing problems associated with the present emergency have been disposed of.

Many of these activities have already called upon the resources of the National Research Council, and it is evident that this new arm of the academy will result in an increased effectiveness of the academy and the National Research Council as public servants.

PAPERS PRESENTED AT THE CAMBRIDGE MEETING

AT the autumn meeting of the National Academy of Sciences, held in Cambridge, Mass., on November 20, 21 and 22, the following papers were presented:

Relation between positron electron pairs and single positives resulting from gamma ray collisions with atomic nuclei: CARL ANDERSON and SETH NEDDERMEYER (introduced by Robert A. Millikan).

Cosmic ray fluctuations and their interpretations: ROBLEY EVANS, ROBERT A. MILLIKAN and VICTOR NEHER.

Evolution of the expanding universe: G. LEMAITRE (introduced by Harlow Shapley).

The physical background of relativistic cosmology: H. P. ROBERTSON (introduced by Harlow Shapley).

The terrestrial abundance of the permanent gases: HENRY NORRIS RUSSELL and DONALD H. MENZEL. There is a fairly general agreement of cosmic and terrestrial abundances of metallic elements, but a large discrepancy in the abundances of the permanent gases, in particular hydrogen, helium, nitrogen and neon. The obvious inference is that the earth has lost most of these gases initially present, as the moon has lost its atmosphere. An examination of the conditions of escape shows that this could have occurred only if the original temperature of the earth were very high, 5000° C. or greater. The cooling would have been very rapid, and the conclusion seems unavoidable that most of the loss occurred during the first few years if not the first few days of the planet's independent existence, with the loss of hydrogen practically immediate. For substances such as water and carbon dioxide, which may enter into the composition of molten magma, no difficulty arises. Under present conditions no atom could escape if purely thermodynamic conditions prevailed. Collisions of the second kind with excited metastable oxygen atoms could, however, impart to hydrogen and helium atoms velocities sufficient to enable them to escape. That such excited atoms are present is shown by the occurrence of the auroral lines.

Radial stellar pulsations of appreciable amplitude: T. E. STERNE (introduced by Harlow Shapley).

Discussion of magnitudes and colors from the Harvard photographic photometry: CECILIA H. PAYNE (introduced by Harlow Shapley).

The necessity for the existence of magnetic fields associated with sun-spot vortices: D. H. MENZEL and T. E. STERNE (introduced by Harlow Shapley).

Polarization of sun's rays reflected by the moon: F. E. WRIGHT. The percentage of polarization in sunlight reflected by different areas of the moon and at different phases was measured during the lunation, September 19 to October 19, 1933, by a visual method and also by means of a thermoelement and rotatable analyzer. In the visual method a special eyepiece was employed with which the percentage polarization can be ascertained, under favorable conditions, to one tenth of one per cent. In this eyepiece a tiltable, plane parallel plate of thin celluloid compensates the plane polarization of the incoming light; a bi-quartz plate serves to rotate the plane of vibration plus 45° in the one half and minus 45° in the second half and to produce a photometric field; a second tiltable plate of thin celluloid is used to introduce a small amount of plane polarized light and thereby to increase the accuracy of the setting, following the practise of B. Lyot; a Savart plate with Nicol or Wollaston prism is employed to detect the presence of polarized light in the compensated beam. The eyepiece was used on the 6-inch refracting telescope of Mt. Wilson Observatory and functioned exceedingly well. The results obtained are shown in a series of tables and graphs. Discussion of the data of measurement, together with a comparison of the results of measurements on terrestrial materials, indicates, in agreement with previous work, that the lunar surface materials are of the nature of volcanic ashes and pumice.

Sun-spots and weather: CHARLES G. ABBOT. In the year 1908, Dr. George E. Hale at Mount Wilson Observatory discovered magnetism in sun-spots. He soon found that magnetic polarities are opposite in adjacent spots. Following up the investigation, it was disclosed that the order of the two polarities is opposite in the north and south solar hemispheres and that the order continues unchanged through each eleven-year sun-spot period, but reverses at the beginning of the next period. Thus it requires two eleven-year periods to bring the sun through a full cycle of magnetic changes. In 1931, the author discovered periodicities of approximately 7, 8, 11, 21, 25, 45 and 68 months in the variation of solar emission of radiation. Indications were found that these periodicities are reflected in terrestrial temperatures. Since November, 1932, assisted by Mrs. A. M. Bond, he has studied these periodicities in the departures from normal temperature at Bismarck, N. Dak. Although they are clearly present, changes of phase and amplitude occur in long ranges of time which hinder their usefulness for forecasting purposes. He has discovered that these changes of phase and amplitude in these periodicities of variation from normal temperatures at Bismarck, N. Dak., are functions of the numbers of sun-spots prevailing. The times of maximum in some periods are set forward by as much as half a period in passing from sun-spot minimum to sun-spot maximum. He attempted with some success to forecast temperature departures by combining periodicity and sun-spot data, but a better

method disclosed itself. He noted that when plotted according to Hale's double sun-spot period the principal features of the temperature departures of Bismarck, N. Dak., showed strongly a tendency to repeat themselves. But it was immediately seen that the true interval for such repetition was 23 years, or 276 months. He perceived that the periodicities in solar variation approximately fixed by him several years ago were nearly submultiples of 276 months. Thus dividing 276 by 3, 4, 6, 8, 11, 13, 15, 18, 25, 34 and 39, we have 92, 69, 46, 34-1/2, 25-1/11, 21-3/13, 18-2/5, 11-1/25, 8-2/17 and 7-1/13 months, of which the second, third, fifth, sixth, eighth, ninth and tenth values are closely approximating to the periodicities announced by him as existing in solar variation. Moreover, all the intervals thus deduced appeared to continue over long intervals in the departures from normal temperature of Bismarck, N. Dak., if, as above stated, attention is given to the sun-spot numbers prevailing. He thereupon conceived that since all the periodicities were submultiples of 23 years, the tedious method of determining periodicities individually might be omitted, and their combined effect might be found by discussion of a 23-year cycle. This proved highly successful. At Bismarck, N. Dak., the monthly mean departures from normal temperature for two periods, 1875 to 1898, and 1898 to 1921, gave features of great similarity. It was found, indeed, as was expected, knowing the irregularity of sun-spots, that the principal features were subject to shiftings of several months, due to changes of phase of constituent periodicities. This was allowed for by using slightly flexible scales of abscissae, alternately expansible and compressible in slight degree, when combining the two 23-year periods. When averaged with these slight adjustments and plotted as a prediction for the interval 1921–1933, the curve of forecast very closely represented the observed march of departures from normal temperature for those twelve years. He then represented in percentages of the monthly mean normal precipitation the observations at Bismarck, N. Dak., for the range 1875 to 1921, thus covering two 23-year cycles. Based thereon, he made a similar forecast of percentage precipitation 1921–1933, which proved to be in close accord both as to magnitudes and features with the observed values. The method is fortunately even more useful for forecasting precipitation than for temperature. Its inexactness is believed to be due to the difficulty of forecasting irregularities in the appearance of sun-spots, and allowing for their effects upon the phases of the component periodicities of variation. Many other stations are being studied. So far as completed, the results confirm the impression that in the 23-year cycle lies the key to long-range weather forecasting. The present paper is preliminary. The author hopes, however, within a few months to be in a position to announce a forecast of temperature and precipitation for numerous stations in all parts of the world for many years in advance. In so doing, he expects to prove that the principal agent in producing variations from normal weather (or climate) is the variation of the sun.

A direct determination of the atomic weight of the electron: R. C. GIBBS and R. C. WILLIAMS (introduced by F. K. Richtmyer).

Limiting current density in ionized gases: ALBERT W. HULL.

The mechanism of cosmic ray counter action: CARL ANDERSON, ROBERT A. MILLIKAN, SETH NEDDERMEYER and WILLIAM PICKERING.

The evaporation and sputtering of thorium from thoriated filaments: IRVING LANGMUIR. The rate of evaporation of electrons, ν_e, (electron emission) from a thoriated tungsten filament depends on the temperature T and on θ, the fraction of the surface covered by thorium atoms. The relation of ν_e to θ and T has been given by Brattain and Becker (*Phys. Rev.*, 43: 428, 1933). From ν_e the change in contact potential V of the filament surface produced by the adsorbed thorium can be calculated by the Boltzmann equation. Knowing σ, the number of thorium atoms per cm², the dipole moment M of each is given by $V = 2\pi\sigma M$. By an equation already used for Cs films on tungsten (I. Langmuir, *Jour. Amer. Chem. Soc.*, 54: 2822, 1932) the 2-dimensional equation of state of the adsorbed film can be calculated from M. Then by Gibbs' adsorption equation the relation of the atom evaporation rate ν_a to θ and T can be determined. It is thus calculated that in the range from $\theta = 0.2$ to $\theta = 0.6$, ν_a varies in proportion to $\varepsilon^{H\theta}$, where $H = 8.1$ in good agreement with the value of $H = 7.8$ given by Brattain and Becker's measurements. A recalculation of the data of numerous experiments in 1921–1923, using the new relation of ν_e to θ, gives data on ν_a as a function of T and θ in good agreement with the values of ν_a calculated from ν_e. A similar recalculation of the data of Kingdon and Langmuir (*Phys. Rev.*, 22: 148, 1923) on the sputtering of thorium from thoriated filaments by ions of various gases leads to new conclusions. The rate of removal of Th is found to be accurately proportional to θ. A new mathematical theory of sputtering is developed, based on the hypothesis that sputtering is purely thermal evaporation from the small areas which are momentarily heated by the ion impacts. The variation between the observed rates of sputtering by high velocity ions is accounted for wholly by differences in the depth of penetration of the ions. The absolute magnitude of sputtering, as well as its variations with voltage, even down to the threshold voltage at which sputtering begins, is satisfactorily given by this theory.

The use of ground and etched crystals in x-ray spectrometry: F. K. RICHTMYER and F. W. BARNES.

Rocking curves obtained by transmission of the x-ray beam through calcite crystals: T. R. CUYKENDALL and S. W. BARNES (introduced by F. K. Richtmyer).

Muscle Shoals and the Tennessee Valley problem: ARTHUR E. MORGAN.

Biological variations in sugar utilization: THORNE M. CARPENTER (introduced by Francis G. Benedict). Canaries and rats were given glucose, fructose and galactose in amounts comparable to those used in previous studies with humans when the total metabolism without food was used as a basis. The gaseous exchange with particular reference to the respiratory quotient was fol-

lowed for three to five hours after ingestion of the hexoses. The results obtained did not resemble those found with man with all three sugars, nor did the rats and the canaries give values resembling each other with all three sugars. The findings indicate that there are distinct biological variations in the metabolism of carbohydrates.

The gaseous metabolism of some dwarfs and giants: ALLAN WINTER ROWE (introduced by Francis G. Benedict). During a recent professional engagement an opportunity presented for a partial metabolic study of a group of dwarfs consisting of four women and one man. In addition, an acromegalic giant, also a member of the troupe, was somewhat more thoroughly investigated. The present report deals with the individual energy metabolism as measured by the oxygen exchange. The estimation of the normality of the respiratory metabolism of the group offers an interesting problem as the dwarfs had the physical stature and sexual immaturity of young children, while their chronological ages ranged from 18 to 34. Analysis is made of the several prediction standards, and the applicability of each to the individual subjects in the series is discussed. The results of earlier investigations on two previously studied patients were added to bridge the gap between the dwarfs and people of normal height. These latter were both adult women of small but not dwarfish stature who had never matured. One was a pituitary case as were the group of the dwarfs; the developmental arrest of the other derived from a congenital luetic status. Depressed basal rates were the rule; in each case, however, a summary of the results of comparison of the observed rate with the several prediction standards reflected the physical and functional status which had engendered the specific somatic abnormality. The extremes of height were, respectively, 95.0 and 228.6 cm.; of weight, 16.3 and 163.3 kilograms; of area, 0.639 and 3.125 sq. meters; and of oxygen consumption, 79.0 and 419.7 cc. per minute. With the exception of the one control case noted above the energy metabolism showed a definite downward trend which in the case of certain comparisons showed deviations as low as −44%.

Necessary versus optimal intake of vitamin G (B_2): H. C. SHERMAN and L. N. ELLIS. Somewhat as has been indicated by the work of others with vitamins A and C, though by the use of different methods and criteria, it is here found that the amount of vitamin G required for optimal results in nutrition is much above that which is demonstrably necessary for the prevention of any sign of specific deficiency or even for the support of good growth. Thus there is advantage in an intake considerably higher than that which appears to be strictly necessary; and the difference between the minimum which suffices from the qualitative point of view and the amount which yields the best results, when studied by comprehensive quantitative methods, is found to be relatively wide. The work here reported covered that part of the life-cycle of the original experimental animals (rats) which lies between late infancy and the completion of the breeding record, together with observations on the early growth of the offspring. The improvement which here resulted from the enrichment in vitamin G of an already adequate diet was chiefly apparent in the superior vitality of the young; but these experiments did not extend over the latter part of the life cycle. The vitamin G intake was varied systematically by quantitative adjustments among the ingredients of a dietary in which the vitamin was furnished in the form of natural food. This plan was adopted partly because in the state of knowledge existing when these experiments were begun, the attempt to devise a more synthetic diet might have led to deficiencies of unknown essential substances, and partly because sufficient amounts of purified concentrates to feed the number of animals needed in such experiments would have been prohibitively expensive to prepare. In the light of the results of simultaneous work and with the aid which is now being given by the Carnegie Corporation of New York through the Carnegie Institution of Washington, it is hoped that experiments can be made with vitamin G as a more nearly isolated factor and that such experiments can be continued throughout the natural lives of the experimental animals. It seems desirable definitely to ascertain whether and how vitamin G functions as one of the chemical factors in the relation of food to the length of normal life.

The nature of the depressor substance of the blood: CYRUS H. FISKE (introduced by O. Folin).

The nerve path of infection in poliomyelitis and its significance: SIMON FLEXNER. While this communication relates specifically to poliomyelitis, it applies in principle to still other infectious and inflammatory diseases of the brain and spinal cord. The experiments were made on *Macacus rhesus* monkeys, in which the virus of poliomyelitis induces a paralytic disease indistinguishable from the epidemic disease occurring in man. The infection is produced by instilling the virus—a suspension in salt solution of the spinal cord of a paralyzed monkey—into the nose. From seven to ten days after the instillation, symptoms of infection arise, increase in intensity and terminate in wide-spread muscular paralysis. The virus gives rise to no detectable pathological changes in the nasal mucous membrane. It possesses an affinity for the olfactory nerve cells—the organ of smell—which lie exposed in this membrane. The hairlike processes (dendrites) of these cells project into a layer of mucus which the virus enters to come in contact with the cells. The dendrites take up the virus and pass it on, by way of the axon or nerve fiber, to the olfactory lobe of the brain, whence it passes on still further, by nerve connections, to more distant parts of the brain and spinal cord. As the virus travels it becomes affixed to the motor nerve cells which control voluntary motion, injures them and thus induces muscular paralysis. Other cellular changes, secondary and reactive in nature, are also induced in the nervous organs. Hence the olfactory nerves carry the virus from the periphery (nasal membrane) to the brain, and they also carry it in the reverse direction from the center (brain) to the periphery. This two-way transport has been shown for the first time in connection with the virus of poliomyelitis. The olfactory nervous structures are to a considerable extent iso-

lated from the blood and lymph, which carry the protective, immune substances effective against impending infections. They afford, therefore, potentially a ready means of penetration of the virus into the central nervous system. It is only after the virus has reached the brain that the cellular reactions in the system, detectable by microscopic and chemical examination of the cerebrospinal fluid, make possible the escape of these protective substances. This phenomenon is more strongly marked among children than among monkeys, which probably accounts for the occurrence of many cases of mild poliomyelitis among children and few among the experimentally infected monkeys. The influence of the isolation of the olfactory nerves is observed in monkeys artificially immunized to the virus. These monkeys may be protected against the paralyzing effects of the virus injected into the brain, and yet respond with paralysis to virus instilled into the nose. Although this report deals only with experimental poliomyelitis, evidence exists showing that other viruses having a strong affinity for the central nervous organs utilize the exposed olfactory nervous structures in the nasal membrane in order to reach the nervous system. The origin of certain epidemic, nervous diseases of the higher animals is becoming explicable in this way.

Tumor-inhibiting factors extractable from tissues: JAMES B. MURPHY (introduced by Simon Flexner). It has proved possible to separate a substance from chicken tumor extracts which, if brought to a proper concentration, is capable of neutralizing the tumor-producing properties of the transmissible agent in its most active form. Furthermore, this factor from the chicken tumor is equally effective in inhibiting the growth of certain transplantable mammalian sarcomas, but is without effect on carcinomas. On the assumption that this inhibitor is related to the factor which controls normal growth of cells, a number of tissues have been tested for tumor-inhibiting properties. So far placenta and embryo skin extracts have yielded fractions having a distinct retarding effect on transplantable carcinomas. The present report deals with the action of these same normal tissue fractions on the course of natural or spontaneous cancer of mice. Their inhibiting action is evident not only on local post-operative recurrences of the disease and on the growth of autografts where there is direct contact between the extract and the cancer cells, but is definitely observable when the test fluids are injected at a distance from established tumors. While the results seem to substantiate the suggestion that the inhibitor from tumors is similar to the balancing factor of normal tissues and would give a possible insight into the mechanism involved in malignancy, the materials utilized are too complex to justify a conclusion at the present time.

The use of hypertonic sucrose solution to reduce cerebrospinal fluid pressure without a secondary rise: L. T. BULLOCK, R. KINNEY and DR. M. I. GREGERSEN (introduced by Walter B. Cannon). Both clinical and experimental evidence proves that the use of hypertonic sodium chloride and glucose solutions for reduction of cerebrospinal fluid pressure is followed by an undesirable secondary rise in the pressure. We have attempted to overcome this undesirable effect by using sucrose. When injected intravenously, this substance is non-toxic, has a high osmotic pressure and is quantitatively excreted by the kidney, together with a considerable volume of body water. In experiments performed on dogs under sodium amytal anesthesia, cerebrospinal fluid pressures were taken in the cisterna magna for 10 to 13 hours. Continuous blood-pressure records were obtained from the femoral artery; urine volume, respiration, heart rate and rectal temperature were noted every 15 minutes. A 50 per cent. sterile sucrose solution was injected intravenously at 5 cc per minute in doses of 3 to 8 grams per kilo body weight. Control experiments without sucrose injection all showed a slow, steady rise of cerebrospinal fluid pressure during the period of observation. There was also a moderate increase in the number of white cells in the spinal fluid. This increase was not produced by sodium amytal alone. In experiments with sucrose the normal control pressure was observed for 1 hour or more prior to the injection. The maximum reduction of cerebrospinal fluid pressure occurred within an hour after injection began. The extent of the reduction (50 to 150 mm of Ringer's solution) was dependent upon the amount of sucrose given and upon the height of the initial pressure. Seemingly, the effect was greater with higher initial pressures. The fall of cerebrospinal fluid pressure was followed during 5 to 7 hours by a gradual rise, occasionally to normal but more frequently to a subnormal plateau. Although the pressure was often observed for 12 hours after injection, there was no indication of the beginning of a secondary rise, except in 3 experiments. In these the terminal rise could be ascribed to definite causes other than sucrose. Injection was followed by a period of active diuresis lasting 3 hours, during which most of the sucrose was eliminated together with a volume of urine 4 times the volume of fluid injected. With doses of 6 grams per kilo, the body fluid lost through the kidney was 4 to 5 per cent. of the total body weight. The absence of a secondary rise of cerebrospinal fluid pressure after sucrose may be explained by the excretion of the agents necessary to produce it, namely, the injected substance (sucrose) and free water. Experiments with sodium chloride and glucose under the same conditions confirmed the experience of other investigators that both substances, more especially sodium chloride, produce a terminal rise of pressure which far exceeds the original level.

Central excitation and inhibition in reflex changes of heart rate: ARTURO ROSENBLUETH (introduced by Walter B. Cannon). Reflex changes of heart rate on afferent maximal stimulation at varying frequencies of the depressor, the left vagus and the sciatic were recorded from cats with either the vagi or the accelerators severed. These responses were compared with those obtained from peripheral maximal stimulation of either the right vagus or the right accelerator. The time-course of the responses was followed by plotting the reciprocal of the intervals comprised by a given number of beats against the corresponding times. The subsidence of central ex-

citation and inhibition in these reflexes may be very long (up to 10 minutes). The maximum of the reflex responses at equilibrium is a continuous function of the frequency of afferent stimulation. The reflex output of the centers is lineally proportional to the excitatory input. For a given degree of tonic activity, the output is a continuous, non-linear function of the inhibitory input. The duration of the subsidence of the reflex responses is a continuous function of the afferent frequency. This subsidence is not explained satisfactorily by the hypothesis of reverberating delay paths. The data presented are hard to reconcile with any physical theory for central excitation and inhibition, whereas they are readily explained as follows. Nerve impulses impinging on a neurone give rise to quanta of an excitatory (c.e.s.) or an inhibitory (c.i.s.) substance. Both c.e.s. and c.i.s. are destroyed at a rate proportional to the concentration. For a steady input and at equilibrium the concentrations of c.e.s. and c.i.s. are proportional to the afferent rate. The output of a neurone is proportional to the concentration of c.e.s. The reflex output is therefore lineally proportional to the excitatory input. C.i.s. combines with c.e.s., inactivating the latter. This combination follows the law of mass-action. The degree of inhibition, as shown by the decrease in output, is therefore not lineally proportional to the inhibitory input.

The recovery period of the auditory nerve and its significance for the theory of hearing: HALLOWELL DAVIS, ALEXANDER FORBES and A. J. DERBYSHIRE (introduced by Walter B. Cannon). One type of auditory theory assumes that the frequency of sound waves is transmitted to the higher nervous centers as a corresponding frequency of nerve impulses in the auditory nerve. To account for the perception of high-pitched tones on this basis it has been suggested that the auditory nerve may have a much briefer recovery period than other mammalian nerves, which might permit of frequencies of impulses as high as 10,000 per second. No direct measurements of the recovery period of this nerve have been made, due to anatomical and technical difficulties. We have succeeded, however, in measuring it by an indirect method. If action currents are led from the auditory nerve by suitable coaxial electrodes which exclude the direct microphonic response of the cochlea and are measured on a cathode ray oscillograph, it is found that their size is roughly constant in response to maximal auditory stimulation at frequencies of 700 and below. The frequency of the action current waves corresponds exactly to that of the stimulating sound. Between 700 and 900, and quite sharply in any given preparation, the size of the action currents falls to approximately one half of this value. A second, though less spectacular drop, is usually seen at about 1,700. The frequency of the stimulating sound may still be detected in the response up to 2,800 per second but no higher. The closely synchronized waves have been gradually replaced by completely asynchronous impulses. Calculations from the known refractory period of nerves at body temperature show that a nerve might follow the rhythm of stimulation up to perhaps 900 per second. Our measurements indicate that this occurs in the fibers of the auditory nerve. The sudden reduction in size of response at about this frequency undoubtedly means that each individual fiber has begun to respond only to alternate sound waves. Since only half the fibers respond to a given wave, the size of the response is half as great as before. The next reduction at 1,700 represents a breaking into three groups, while at 2,800 the responses become completely irregular. This alternation of activity, succeeded by irregularity, has already been described by one of us as characteristic of the response of excised peripheral nerves stimulated electrically at high frequencies. We conclude that the auditory nerve is in no way unique in respect to its ability to transmit high frequencies of impulses but has a functional recovery period of at least 1.1 σ. Furthermore, even by virtue of rotation of activity the frequency of stimulation is not represented centrally above 2,800 per second. Therefore, pitch discrimination for high tones must depend upon some selective activity in the cochlea and not involve the frequency of nerve impulses. For tones of low pitch, however, a frequency theory is still possible.

The functions of the premotor area of the cerebral cortex: J. F. FULTON (introduced by Raymond Dodge).

Ocular-rotation centers for the two primary axes: WALTER R. MILES.

Loss of virulence in the protozoön of "blackhead," a fatal disease of turkeys, and the immunizing properties of attenuated strains: ERNEST EDWARD TYZZER (introduced by E. B. Wilson). The disease to which the rather inappropriate name "blackhead" has been applied is of wide occurrence in gallinaceous birds, and has been found in the quail, prairie-chicken, heath-hen and ruffed-grouse, as well as in the turkey. The infection is widely prevalent in common chickens but, not being seriously affected, they become carriers and evidently serve as the chief source of infection. The pioneer work on this infection was done by Theobald Smith, who in 1895 discovered the causal agent, which is a protozoön, *Histomonas meleagridis*, and made other important contributions to the knowledge of the disease. Following a period of years devoted to the study of sources of the infection and modes of its transmission, the present investigation deals with changes in the character of this protozoön, when grown for long periods in culture medium. On being propagated outside the body of the bird, the protozoön gradually loses virulence, remaining infective for young turkeys and other birds, but no longer producing serious disease. Young turkeys infected through inoculation with attenuated strains are protected against virulent strains of the protozoön which are almost 100 per cent. fatal to unprotected birds. Once vaccination is accomplished, continuous exposure to virulent infection furnishes the most complete protection. Under long cultivation, the immunizing properties of a strain of Histomonas may in turn be lost. While our evidence is by no means complete, there is much to show that the immunity resulting from infection with attenuated strains of Histomonas is brought about by slight and transient

invasions of the host tissues, which are not sufficiently progressive to produce the gross lesions of disease. Under continued propagation on culture medium, there is evidently a further loss in the invasive properties of the protozoön and it may now fail to immunize completely. While it is possible that these results may lead to a method of vaccinating turkeys against blackhead, there are at the present time serious practical difficulties that prevent the adoption of the procedure for commercial purposes.

Active and passive immunization in typhus fever: HANS ZINSSER and M. RUIZ CASTANEDA.

The schizophrenic psychosis with special reference to homeostasis: R. G. HOSKINS (introduced by E. B. Wilson).

Polyisomerism and anisomerism in cranial and dental evolution among vertebrates: WILLIAM K. GREGORY.

Mutation rate increased by aging seeds as shown by pollen abortion: J. L. CARTLEDGE and A. F. BLAKESLEE. Up to the present time the most consistent method of inducing hereditary changes in plants and animals has been through the use of radiations such as radium and x-rays. The recent findings of Navashin that root tips of Crepis plants grown from old seed show an excessive number of chromosomal abnormalities suggested that aging seed might induce changes that could be inherited. Tests this past summer have in fact shown a definite influence of age of seed upon the number of mutations in the common jimson weed (*Datura stramonium*). Pollen abortion was used as an index of the mutation rate, and ranged from about half of one per cent. of plants affected from one-year-old seed to nearly 10 per cent. of plants affected from seed seven to eight years old. In mutation experiments with radium and x-rays, pollen abortion has proved the most convenient and the most delicate measure of mutation rate. The abortion in some cases is due to chromosomal mutations which, when heterozygous, may cause the disintegration of definite proportions of the pollen grains. In other cases the abortion is due to single genes, causing half of the pollen grains to be defective. From differences in the appearance of the abnormal grains it is usually possible to distinguish between the aborted grains due to chromosomal and those due to gene mutations, as has been previously shown by cytological and breeding tests. A plant develops from several initial cells in a seed, and in any one of these a mutation may occur. Hence different branches of the same plant may differ in respect to pollen abortion. In order to test the effect of aging seeds of Datura, plants of the Standard Line 1 were grown from seeds up to ten years old, and two flowers from each plant were examined for pollen abortion. Gene and chromosomal mutations were found in approximately equal numbers, and the mutations increased about in the order of one per cent. per year. Thus 331 plants from seeds less than one year old gave two mutations (0.6 per cent.), while 3.7 per cent. were found in 872 plants from seeds 3–4 years old, and 8.7 per cent. in 242 plants from seeds 7–8 years old. No plants from 8–9 year old seeds were tested. One hundred plants from 10 year old seeds gave the somewhat lower rate of 7.0 per cent. mutations. While on the whole the percentage of germination is lowest in the oldest seeds, this percentage varies considerably among the progenies of individual parents within each age group, and seems to have no close relation to the number of mutations thrown. The increase in number of mutations is not due to the selective elimination of normals. As far as is known, the seeds were not exposed to any unusual source of radiations, so that this factor seems to be ruled out as the cause of the increased mutation rate. These experiments on Datura form a confirmation of the work of Navashin on the root tips of Crepis plants grown from aged seeds. They deal with a different species and with a part of the plant more closely connected with the hereditary mechanism. In the experiments of Navashin and Shkvarnikov, increased temperatures produced the same effects as aging seeds. It is not as yet clear what the ultimate mechanism may be that thus brings about genetic changes in aged and heated seeds. Presumably the increased temperature and time work indirectly; the former accelerating events which take place within the seed, the latter giving an opportunity for the accumulation of mutations. The definite influence of age and heat upon stored seeds is of interest from its possible relation to the problem of evolution in nature.

Combined sound and light distributor: GEORGE O. SQUIER. The last "half-century of progress" has witnessed the birth and development of electrical communication by sound and power distribution of light. The next logical step forward will be to combine these utilities into single units of heroic models for our parks and superhighways, and also artistic interior combinations for the home. The metal aluminium is the third most prevalent in the earth's crust, and the present trend indicates that the next "half-century of progress" will register a wonderful development of artistic cast, rolled and extruded models of this regal element in wide applications both outside and inside our homes. The "Fountain of Science," by Mrs. George Woodruff, which has been presented to the fair, should remain *in situ* where it now adorns the Science Building. In architecture, with two exceptions, the entire sky-line of the lake front in Chicago did not exist at the time of the Columbian Exposition in 1893. The basic design of A Century of Progress entirely abandons this plan and is developed upon low horizontal lines in the extreme, with but a few elevations which can hardly be described as towers. In future, with a 99 year lease on a city block, the "optimum height" will likely turn out to be less than a dozen stories. The Art Institute of Chicago, which is a part of A Century of Progress, is exclusively art without science; the Hall of Science, under the same management, is exclusively science without picture art. If Whistler's "Mother" had been hung in the balcony library of priceless scientific books, in the Great Room of the Science Building, and Arcturus made to ring beautiful chimes daily at the top of the Grand Stairway of the Art Institute Building, many more thousands of

visitors would have returned to their homes with better knowledge and understanding of both of these key centers of the great fair. Men began to develop art without science. They ended up with science without art. The future must aim to combine the five branches of art—painting, sculpture, architecture, music and poetry—with science into balanced units of transcendent beauty.

A geologic section of the Quabbin aqueduct in central Massachusetts: CHARLES P. BERKEY and FRANK E. FAHLQUIST.

Eocene primates from California: CHESTER STOCK (introduced by John C. Merriam). Two new primate genera belonging to the family Tarsiidae (Anaptomorphidae) are recognized among the fossil mammals now being recorded from the late Eocene Sespe deposits of the Simi Valley region, Ventura County, California. One type, found in association with a very late Eocene fauna, is related to the genera *Omomys* and *Hemiacodon* from the Bridger formation. It represents the latest primate to be recorded from the North American Tertiary. The second type, found with a late Eocene fauna at a locality approximately 900 feet lower than the very late Eocene stage in the Sespe deposits, is related to and possibly derived from the Bridger genus *Washakius*. The Californian species extend considerably the known areal distribution of this lemuroid group in North America, since previously described forms have all been recorded from the intermontane basins of the Rocky Mountain region.

Present status of the problem of the antiquity of man in North America: JOHN C. MERRIAM. Recent advances are based on widely distributed discoveries in paleontology and archeology, with important contributions through geologic correlation, geomorphology and glaciology. Available data regarding occurrence indicate increasing closeness of approach to the present age by faunal types considered characteristic of the Pleistocene, also more extended range of human skeletal remains and artifacts into deposits preceding those characteristic of the present epoch. Association of artifacts with apparently undisturbed remains of extinct animal types, such as ground sloth and other forms characteristic of the Pleistocene, suggests the presence of man at a time earlier than has been generally assumed for North America. The nature of the skeletal remains and the character of the artifacts found have not in themselves required the assumption that they represent relatively early stages in human evolution. The precise geologic dating of most deposits in which this mingling of types occurs is still a problem for careful discussion.

Association of artifacts with mammoth and bison in eastern New Mexico: EDGAR B. HOWARD (introduced by John C. Merriam). Association of artifacts with bones of extinct animals in eastern New Mexico indicates that man was contemporaneous with the extinct elephant and bison in that region. Old lake beds revealed quantities of bison and elephant bones at what appears to have been the old surface of these lakes, where well-chipped spear-points and knives and scrapers were found. In two localities charcoal and burned animal bones were found together with artifacts below the old surface. One of these hearths was several feet below the levels of the bison and elephant bones. Many of the spear-points are similar to the so-called Folsom points; others are as well made but with a dorsal ridge, instead of grooves along the faces. Work carried on by the University Museum for several years previously turned up evidence in line with the associations mentioned above. In a cave near Carlsbad, New Mexico, among other things, musk-ox and bison bones were found in a bed of charcoal and ashes with a grooved point, all at a level four feet below a Basket Maker burial. These facts, in the light of reports of a similar nature from other regions of the country, make it appear that man must have existed at the same time as these extinct animals. When this was is still to be determined.

An investigation of the stresses in longitudinal welds: WILLIAM HOVGAARD. This paper is a report on a theoretical and experimental study carried out during the last four years at the Massachusetts Institute of Technology. It begins with a brief account of research made by the author, already reported, at least partly, in the Proceedings of the National Academy in 1930 and 1931. That work was preliminary and suggested a more complete study of the stresses in the structures which were connected by the weld. The first attempt in this direction was a thesis for the master's degree prepared under the direction of Dr. Heinrich Hencky by three of the students in the course of naval construction. It dealt with the case where a reenforcing web is connected by a spot weld at each end to a continuous plate subject to a longitudinal pull. Only the stresses in the plate, but not in the web, were studied. The next attempt was a thesis for the degree of doctor of science prepared partly under the direction of Dr. Hencky by Y. C. Yeh, a student in the course of naval architecture and naval construction. In this case the welds extended the whole length of the web and the state of stress in the web as well as in the plate was investigated. First the shearing stress in the weld was found by known methods for a plate and web of infinite extent. Employing elliptic coordinates the form of stress function F was developed by the method of complex integration, whereupon stresses and displacements could be found for the infinite plate and web. Correction for the presence of the finite boundaries was made by adding several stress functions to those for the infinite plate and web, each of which functions satisfied the biharmonic equation $\nabla^4 F = 0$ as well as the boundary conditions. Dr. Yeh also gave the solution for a tapered web and for various thicknesses of plate and web as well as for variation in the modulus of elasticity. Finally, an extensive experimental study of the stress field in the specimen analyzed by Dr. Yeh was made by two students, one of naval construction and one of naval architecture in a thesis for the degree of master of science. The results checked very well with the theoretical formulas. According to Dr. Yeh's formula for the shearing stress in the weld, the stress goes to infinity at the ends of the web. The author proposes a modification of this formula,

by which the maximum stress is limited to that at the yield point, such as actually must be the case.

Dielectric properties of crystals: HANS MÜLLER (introduced by J. C. Slater).

Chemical structure and optical activity: P. A. LEVENE and ALEXANDRE ROTHEN.

Contrasting properties of ions, zwitterions and uncharged molecules: EDWIN J. COHN (introduced by J. B. Conant).

A development of a theoretical basis for the behavior of controlled time-temperature curves: EVALD L. SKAU and WENDELL H. LANGDON (introduced by F. G. Keyes). Assuming that a homogeneous and perfectly conducting sample is so arranged that it can lose or gain heat only by radiation to or from the surroundings so that Newton's law of cooling is applicable, and assuming that the temperature of the surroundings is raised or lowered at a constant rate, the following propositions have been proved analytically. I. That if the specific heat of the sample is constant with respect to the temperature the temperature difference between the sample and the surroundings approaches the constant value $\frac{C_p}{K}\frac{d\theta_s}{dt}$, where C_p is the specific heat of the sample at constant pressure, K is a constant of the apparatus, and $\frac{d\theta_s}{dt}$ is the rate of change of the temperature of the surroundings with respect to the temperature. II. That if now the specific heat of the sample begins to increase progressively with the temperature (so as to be concave upward) the time-temperature curve for the sample then becomes concave downward in case $\frac{d\theta_s}{dt}$ is positive, *i.e.*, in the case of a heating curve.

Demonstration of high-speed photography of motions of animals and insects: H. E. EDGERTON and K. J. GERMESHAUSEN (introduced by K. T. Compton). A short reel of motion pictures illustrating the use of high-speed motion pictures for analyzing the motions of biological subjects was shown after the particular method of taking the photographs was described. The camera used for taking these pictures uses stroboscopic light as a source of illumination of a period sufficiently short to effectively stop the object being photographed and to take the pictures on the continuously-moving film without blurring. The motion pictures showed a cat turning over in mid-air after being dropped upside down (500 frames per second), a snake's tongue in action (250 frames per second) and a house fly in action (6,000 frames per second).

A solution of the Poincaré continuation problem: MARSTON MORSE.

Boolian algebras and their applications to topology: MARSHALL H. STONE (introduced by G. D. Birkhoff).

SCIENTIFIC EVENTS

CONSTRUCTION AT THE BELTSVILLE EXPERIMENT STATION

ALLOCATION of more than $1,750,000 of funds for new construction on government property near Beltsville, Md., as a part of the public works program will enable the U. S. Department of Agriculture to develop there a model experiment station for agriculture.

For years the department has been making plans for equipment that would facilitate research on numerous agricultural problems. This work has been conducted heretofore at scattered stations in the vicinity of Washington, D. C. The present building program—designed primarily to relieve unemployment—provides a scheduled stage of construction for July 1, 1934, which is years ahead of progress that would have occurred in the normal course of events. Plans likewise involve the acquisition of about 1,000 acres of land to consolidate government property now in two tracts.

The largest single construction unit will be the new three-story animal-husbandry laboratory. It will provide about one million square feet of floor space and will house a group of laboratories dealing with animal nutrition, genetics, meat and wool investigations and scientific studies involving small animals. This building will cost about $450,000 and will permit an economy and thoroughness in animal husbandry research more nearly compatible with the needs of the many cooperative projects with states and other agencies which center at Beltsville.

For moving the facilities of the Bureau of Animal Industry Experiment Station from Bethesda, Md., to Beltsville, $265,000 has been allowed. This fund will provide a number of small buildings required for the proper isolation and quarantine of many of the animals kept under test and observation in studies of disease.

The poultry-nutrition laboratory, constructed last year, also is modern and will be supplemented by new buildings which will make the plant one of the best equipped poultry research stations in the world.

The field station of the Zoological Division of the Bureau of Animal Industry provides a place for so-called second-stage investigations of parasites. The first-stage studies are carried out at Washington, D. C. The present plans call for a laboratory with rooms and facilities for insectaries, aquariums and vivariums of various sorts for raising suitable hosts of worm parasites.

The $158,300 granted to the Bureau of Dairy Industry will provide for the construction of nine new

buildings and also for making other improvements. The principal new structure will be a laboratory and dairy-products building equipped for experimental work in the manufacture of dairy products and by-products on a factory scale. It is also proposed to complete the construction of the nutrition laboratory, which was begun in 1931. This building, when completed and equipped, will provide adequate and modern laboratory facilities for investigational work in all phases of dairy-cattle nutrition.

The $135,000 allotted to the Bureau of Entomology will provide four structures: (1) A semi-fire-proof building to house investigations on bee culture now carried on at Somerset, Md.; (2) a semi-fire-proof building to house basic studies on insects now conducted in a rented building at Takoma Park, Md.; (3) greenhouses to replace those used by the bureau on the department grounds at Constitution Avenue and 12th Street for investigations on insects injurious to greenhouse plants, and (4) mushroom house for investigations on insects attacking mushrooms.

The newly acquired land, in addition to its uses for building operations, will provide space for studies of dual-purpose cattle, hogs and chickens and will also provide testing plots for the Bureau of Entomology.

EXPERIMENTS ON THE PREVENTION OF SOIL EROSION

A NATIONAL experiment in land use, devoted to studying the prevention of soil erosion and providing for removal from cultivation of submarginal land instead of the average land required in the crop reduction programs, is being undertaken cooperatively by the Replacement Crops Section of the Agricultural Adjustment Administration and the Soil Erosion Service of the Department of the Interior. The experiment was authorized upon the recommendation of Secretary of Agriculture Wallace and Secretary of Interior Ickes. It will cover two million acres of land in 10 different regions.

Under the cooperative program, in those areas where projects of the Soil Erosion Service are located, farmers who reduce acreage under crop reduction programs may substitute acres of submarginal land for the average land that would be taken out of production under the terms of their contracts. Under such an arrangement, for instance, a farmer whose contract would require him to remove five acres of average land from production would have the privilege of removing, instead, 10 acres of submarginal land which was half as productive as his average land.

The Soil Erosion Service, of which H. H. Bennett is director, has chosen tentative locations for 10 erosion prevention projects. Each project includes about 200,000 acres and covers an entire watershed. Farmers who substitute submarginal land for average land under their contracts, will be asked to use the methods recommended by the Soil Erosion Service to prevent erosion of their land.

In the opinion of Joseph F. Cox, chief of the Replacement Crops Section of the Agricultural Adjustment Administration, these projects, being scattered, will provide demonstrations in different regions and under different conditions of what needs to be done to prevent erosion and the use which can be made of submarginal land.

The tentative locations of the ten soil erosion prevention projects are:

Upper Mississippi Valley, near LaCrosse, Wisconsin.
North Central Missouri and South Central Iowa, near Bethany, Missouri.
Central Illinois, in McLean County.
Central Texas, near Temple.
South Carolina Piedmont, near Spartanburg.
Pacific Northwest, in Palouse section, near Pullman, Washington.
Oklahoma Red Plains, near Stillwater.
Tennessee Valley.
Kansas, near Mankato, in Jewell County.
A large project, including land in Arizona, New Mexico and Utah, known as the Navajo project.

The Replacement Crops Section will extend its erosion prevention work beyond the projects in which it is cooperating with the Soil Erosion Service. Erosion-preventing or soil-improving crops are recommended by the section for all land taken out of production, and it plans to supply farmers with full information on crops for these purposes. The work done by the Soil Erosion Service on the 10 projects will be much more intensive, however, than that done elsewhere.

THE MORRIS FOUNDATION FELLOWSHIPS

FIVE Morris Foundation fellowships in botany, each of which carry a stipend of $1,200, have been awarded for the current academic year by the committee on administration of the Morris Arboretum of the University of Pennsylvania, as announced by Dr. Rodney H. True, director of the arboretum.

Recipients of the fellowships, recommended by the scientific staff of the arboretum from among a large number of applicants, are: Lewis E. Anderson, Batesville, Miss.; Miss Ruth Beall, Riderwood, Md.; Thomas W. Childs, Salem, Ore.; Miss Esther L. Larsen, Crosby, N. D., and William E. McQuilkin, Cambridge, Nebr.

In her will bequeathing the Morris Arboretum to the University of Pennsylvania the late Miss Lydia Thompson Morris expressed a desire that post-graduate work in botany be conducted at the arboretum, and the appointment of the five Morris fellows marks the first step taken in accordance with her wish.

Mr. Anderson, who was graduated from Mississippi State College with the degree of bachelor of science in 1931 and received a master of arts degree from Duke University this year, will carry on research work on the cytology of species of the mock orange Philadelphus, of which the arboretum has an exceptionally wide collection.

Miss Beall, a graduate of Goucher College in 1925 and later a graduate student at the Johns Hopkins University, will employ the newly developed Allison Optical Analyzer in a study of chemicals used in botanical research, while Mr. Childs, who was graduated from Oregon State Agricultural College in 1929 and has served as an assistant in forest pathology work in the Bureau of Plant Industry, will study diseases of trees.

A special study of the flora of Delaware will be made by Miss Larsen, who received a bachelor of arts degree from the University of Montana in 1925 and a master of science degree from Washington University, St. Louis, in 1926.

Mr. McQuilkin, who was graduated from Doane College, Nebraska, with the degree of bachelor of arts, in 1925 and who also holds a master of arts degree from the University of Nebraska, will study the relation of roots to soil characteristics.

According to Dr. True, the character of the research work undertaken by a number of the fellowship holders will require them to divide their time between the Morris Arboretum and the botanical laboratories on the university campus.

THE TEXAS ACADEMY OF SCIENCE

THE annual meeting of the Texas Academy of Science was held at Dallas on October 20 and 21. In addition to papers presented before the sections, group luncheons with round table discussions were held as follows. Physicists: "Physical Science Opportunities in Texas," Dr. H. A. Wilson, Rice Institute, presiding. Geologists: "Geological Opportunities in Texas," Dr. E. H. Sellards, Bureau of Economic Geology, presiding. Biologists: "Biological Opportunities in Texas," Dr. Hardy C. Kemp, presiding. There was also a joint meeting of all biological sections and the Texas Entomological Society.

The annual banquet was followed by three addresses: The president's address, by Dr. E. N. Jones, Baylor University; "Some Geological Beginnings in Texas," by Dr. Robert T. Hill, and "Plant Life of the Past," by Dr. A. Noé, University of Chicago.

Following Dr. Hill's address the academy conferred on him a life fellowship.

The total attendance at sectional meetings, luncheon discussions and general sessions was about three hundred and fifty.

The following officers were elected for the coming year:

President: B. C. Tharp, professor of botany, University of Texas.
Executive Vice-president: J. G. Burr, director of research, State Fish, Game and Oyster Bureau.
Secretary-Treasurer: Frederick A. Burt, associate professor of geology, A. and M. College.
Vice-president for Section 1: J. C. Godbey, professor of chemistry, Southwestern University.
Vice-president for Section 2: Mayne Longnecker, assistant professor of biology, Southern Methodist University.
Vice-president for Section 3: W. J. McConnell, dean of College of Industrial Arts.
Vice-president for Section 4: Gayle Scott, professor of paleontology, Texas Christian University.
Dr. S. W. Bilsing, professor of entomology, A. and M. College, reelected representative to the American Association for the Advancement of Science.

OFFICERS OF THE AMERICAN SOCIETY OF TROPICAL MEDICINE

AT the meeting of the American Society of Tropical Medicine held in Richmond, Virginia, from November 15 to 17, the following officers were elected for the ensuing year:

President: Dr. F. F. Russell, International Health Division, Rockefeller Foundation, New York, N. Y.
President-elect: Dr. E. B. Vedder, Washington, D. C.
Vice-president: Dr. F. W. O'Connor, College of Physicians and Surgeons, Columbia University.
Secretary-Treasurer: Dr. Henry E. Meleney, Vanderbilt University School of Medicine.
Editor: Dr. C. F. Craig, Tulane University School of Medicine.
Councilors: Dr. G. R. Callender, Fort Sam Houston, Texas (1 year); Dr. G. C. Shattuck, Harvard Medical School (1 year); Dr. E. C. Faust, Tulane University School of Medicine (2 years); Dr. H. C. Clark, Gorgas Memorial Laboratory, Panama (2 years); Dr. T. B. Magath, Mayo Foundation, Rochester, Minnesota (3 years); Dr. S. S. Cook, U. S. Navy Department (3 years); Dr. E. B. McKinley, George Washington University School of Medicine (4 years); Dr. A. C. Reed, University of California Medical School (4 years).

The following honorary members were elected:

Dr. William H. Welch, the Johns Hopkins University.
Sir Leonard Rogers, London School of Hygiene and Tropical Medicine.
Dr. Bailey K. Ashford, Medical Corps, U. S. Army, retired, School of Tropical Medicine, San Juan, Puerto Rico.
Dr. Charles Nicolle, director of the Pasteur Institute, Tunis.
Dr. W. Schüffner, School of Tropical Medicine, Koloniaal Institut, Amsterdam.

The society voted to hold its next meeting in conjunction with the meeting of the Southern Medical Association in San Antonio, Texas, in November, 1934.

AWARD OF THE TOWNSEND HARRIS MEDALS OF THE COLLEGE OF THE CITY OF NEW YORK

FOR the first time since its organization in 1853, the Associate Alumni of the College of the City of New York honored distinguished alumni for their achievements and for service to the college at the fifty-third annual dinner held in November. Five men received the Townsend Harris Medals, awarded for outstanding post-graduate attainments in their respective fields of endeavor.

According to a press report sent out by the college, the Alumni Service Award, a medal also lately established, was granted to 31 men who had advanced the welfare of the college through significant alumni activity. The awards are made possible through a contribution of the class of 1906 two years ago. Both medals are the work of Albert P. D'Andrea, '18, of the department of art.

The first recipients of the Townsend Harris Medals have gained distinction in the fields of medicine, engineering, religion, architecture and politics. They are Dr. William H. Park, '83, director of the Bureau of Laboratories of the New York Department of Health; Gano Dunn, '89, electrical engineer; the Rev. Dr. Joseph Herman Hertz, '91, chief rabbi of England; John Russell Pope, '93, leading architect, and United States Senator Robert F. Wagner, '98.

More than 600 alumni and guests attended. The principal speaker was Colonel Hugh L. Cooper, the engineer, who described the engineering projects he has recently supervised in Russia. The other speakers were Dr. Lewis Freeman Mott, '83, who represented the fifty-year class; Joseph Dannenberg, '08, who spoke for the twenty-five-year class, and President Frederick B. Robinson, '04, who reviewed for the alumni recent intramural developments. Dr. Walter Timme, '93, president of the Associate Alumni, was toastmaster.

Dr. Park, who will be seventy years old on December 30 of this year, recently occasioned public opposition to his proposed retirement from the Board of Health of New York City because of his remarkable experimental work. Mayor O'Brien supported the plan to continue him in office. After receiving his A.B. degree at the College of the City of New York in 1883, Dr. Park studied at the College of Physicians and Surgeons and at the University of Vienna. In 1894 he became director of the New York Health Department Bureau of Laboratories, and has held that post with distinction since then. For thirty-six years he has been professor of bacteriology and hygiene at the Bellevue Hospital Medical School. He serves the state and nation as a consulting bacteriologist in their respective health divisions. He is president of the American Public Health Association.

Gano Dunn has gained distinction for his work in the field of electrical engineering. Even before his graduation from City College in 1889 he worked for three years with the Western Union Telegraph Company. Two years after he joined the J. G. White Construction Company, he became president, a position he holds to this day. Mr. Dunn has been president of the New York Electrical Society, the American Institute of Electrical Engineers, the Engineering Foundation, and has served as chairman of the National Research Council and the John Fritz Medal Board of Award.

SCIENTIFIC NOTES AND NEWS

DR. FRANK R. LILLIE, since 1931 dean of the Division of Biological Sciences of the University of Chicago, has been appointed Andrew MacLeish distinguished service professor in "recognition of his brilliant and fruitful service to the university." There are six endowed professorships for distinguished service in the university.

THE first award of the gold medal of the Royal Agricultural Society of England in recognition of distinguished service for agriculture has been made to Sir Thomas Middleton, vice-chairman of the Development Commission. In commenting on this award, *Nature* writes: "Much of the success of the present system of agricultural education and research is due to him. He was one of the earliest members of the Agricultural Education Association, and was the first president of the newly constituted Section M, Agriculture, of the British Association at the Dundee meeting in 1912."

ACCORDING to the *Journal* of the American Medical Association, the Medical Association of South Africa has awarded its gold medal for "meritorious services rendered to the profession" to Dr. A. J. Orenstein, director of sanitation of the Rand mines who for six years held office as president of the association and was largely responsible for the amalgamation of the two medical associations in South Africa. Dr. Orenstein is lecturer on tropical medicine at the University of the Witwatersrand.

THE degree of doctor of science has been conferred by the University of London on Sir Thomas Barlow,

professor of clinical medicine at the University of London, and on Sir Flinders Petrie, professor of Egyptology.

DR. L. C. GRATON, professor of mining geology at Harvard University, has been elected a corresponding member of the council of the Chemical, Metallurgical and Mining Society of South Africa.

DR. FRANK T. SHUTT has retired as dominion chemist and assistant director of the Experimental Farms of the Canadian Department of Agriculture after serving for more than forty-five years. On the occasion of his retirement, Dr. Shutt was the recipient of gifts from the Division of Chemistry, over which he had presided for so many years, and from the general staff of the Central Experimental Farm, Ottawa. In the presence of the technical staff of the farm an oak tree was planted on the main lawn by Dr. Shutt to commemorate his many years of service.

DR. WILLIAM HORNADAY, from 1896 to 1926 director of the New York Zoological Park, celebrated his seventy-ninth birthday on December 1.

C. M. JANSKY, JR., of Wisconsin, has been elected president of the American Institute of Radio Engineers for 1934.

AT the annual general meeting of the Cambridge Philosophical Society, the following officers were elected: *President,* Professor J. Barcroft; *Vice-presidents,* Dr. F. H. A. Marshall, Dr. F. W. Aston, Professor E. K. Rideal; *Treasurer,* F. A. Potts; *Secretaries,* F. P. White, Dr. J. D. Cockcroft, Dr. H. Hamshaw Thomas; *New Members of the Council,* F. T. Brooks, Professor J. E. Lennard-Jones, H. L. H. H. Green, Dr. O. M. B. Bulman, P. I. Dee.

THE appointment of Frederick D. Richey, now in charge of corn investigations, Bureau of Plant Industry, as associate chief of that bureau, effective on January 1, has been announced by Secretary of Agriculture Henry A. Wallace. Mr. Richey will aid Chief Knowles A. Ryerson, whose appointment was recently announced, in the general administration of the bureau, and will give special attention to research activities. Mr. Richey succeeds Dr. Karl F. Kellerman, who will become head of a new Division of Plant Disease Eradication and Control in the Bureau of Entomology. This division will have transferred to it all activities directed toward the control and eradication of the phony peach disease, blister rust, barberry, citrus canker and Dutch elm disease.

RICHARD W. SMITH, assistant state geologist of Georgia for seven years, has been appointed acting state geologist to fill the place of Samuel W. McCallie, who died on October 26.

DR. H. L. WALSTER, of the North Dakota Agricultural College, was recently made director of the North Dakota Agricultural Experiment Station. Mr. Walster will serve as dean of the College of Agriculture as well as director of the Experiment Station.

E. W. NELSON, of Ogden, Utah, has been appointed associate professor of forestry at the State University of Utah, to fill the vacancy in grazing management caused by the absence of Dean T. C. Spaulding, who has been granted a year's leave of absence to serve as director of federal relief in Montana.

DR. B. F. BARNES has been appointed head of the department of biology of the Chelsea Polytechnic Institute, which will become vacant on January 1 owing to the retirement of H. B. Lacey. For the past nine years Dr. Barnes has been the senior lecturer in the department of botany at Birkbeck College, University of London.

DR. D. H. INGALL, since 1931 assistant director and research manager of the British Non-Ferrous Metals Research Association, has been appointed principal of the Borough Polytechnic, London, in succession to J. W. Bispham, who has been promoted to be assistant education officer in technology under the London County Council.

N. P. ROBIE, formerly with the Bureau of Standards, Washington, D. C., has become a member of the research department of the Carborundum Company, Niagara Falls, N. Y.

THE Warner & Swasey Company, Cleveland, announces the association with the firm of C. A. Robert Lundin, formerly of Watertown, Mass. He is the son of the late Carl A. R. Lundin, who was for many years superintendent of the works of Alvan Clark and Sons, Cambridge, Mass.

DR. H. W. GILLETT, director of Battelle Memorial Institute, Columbus, Ohio, has announced the establishment at the institute of a research project sponsored by the Elgin National Watch Company, for the study of the metallurgy of watch-making. James L. Gregg and A. W. MacLaren, metallurgists, and Dr. H. W. Russell, chief physicist, have been designated to carry out the work.

PROFESSOR H. L. BOWMAN, in charge of the department of civil engineering at the Drexel Institute, Philadelphia, has been appointed chairman of a committee of the Philadelphia Section of the American Society of Civil Engineers which is to propose a schedule of salaries for engineers in this area who are connected with the construction industry. This action is taken in anticipation of the approval of a code for the Professional Engineer Division of the Construction Industry. Under the code a salary schedule, developed through negotiations between employer and employee groups, must be submitted within four months.

SHERMAN E. JOHNSON, head of the department of agricultural economics of the South Dakota State College, has been granted leave of absence to assist at the Brookings Institution at Washington, D. C., during the ensuing year.

DR. H. K. HAYES, chief of the division of agronomy and plant genetics at the Minnesota Experiment Station, returned recently from a year spent at the New York State College of Agriculture, where he served as acting professor of plant breeding.

DR. A. C. REED, director of the Pacific Institute of Tropical Medicine, lectured before the department of medical zoology of the Johns Hopkins School of Hygiene on November 27 on "Chemotherapy of Amoebiasis."

DR. VILHJALMUR STEFANSSON opened a winter series of lectures at the Explorers Club, New York City, on November 24. He spoke on "Transpolar Commerce by Air" and showed lantern slides made while he was in the Arctic.

DR. E. W. GUDGER, of the department of ichthyology of the American Museum of Natural History, New York City, spoke on November 24 before the New York Aquarium Society on "What the Aquarist Can Do for Ichthyology."

DR. HERBERT LEVINSTEIN will deliver the fifth S. M. Gluckstein memorial lecture before the British Institute of Chemistry on December 15 on "The Chemist as a Directing Force in Industry."

THE annual meeting of the Northwest Scientific Association will be held at the Davenport Hotel in Spokane on December 27 and 28. Besides three general meetings, section programs will be held in botany-zoology, chemistry-physics, education, engineering, forestry, geology-geography, medicine and social science.

SIR FREDERICK GOWLAND HOPKINS, president of the Royal Society, presided at the twenty-first anniversary dinner of the Biochemical Society which was recently held in London. The guests of honor were Professor R. H. A. Plimmer, who was secretary and treasurer from 1911 to 1913; J. A. Gardner, treasurer since 1913, and who, with Professor Plimmer, was responsible for convening the first meeting of the Biochemical Club in 1911, out of which the Biochemical Society was formed in October, 1912, and Professor A. Harden, editor of the *Biochemical Journal* since it was taken over by the Biochemical Society in 1913. The chairman, in proposing the toast of the Biochemical Society, said that of the original members of the society 73 were still members and 23 were present at that dinner. The total membership is now 825.

DR. FREDERICK L. HOFFMAN, in behalf of the Prudential Insurance Company and himself, has entered into an agreement with the Cancer Research Laboratory of the University of Pennsylvania to transfer to that institute as an unconditional gift his entire collection of cancer material and collateral medical and vital statistics for permanent preservation and more convenient access to cancer research workers. The collection includes data and statistics collected in connection with Dr. Hoffman's work on cancer research during the last fifteen years. Dr. Hoffman has also in preparation an extended report on cancer in relation to diet and nutrition. This report has been made possible through the generosity of Mr. Samuel S. Fels, president of the Fels Naphtha Soap Company, Philadelphia. Dr. Hoffman intends to remove to Philadelphia in the near future in order to be in close touch with the Cancer Laboratory, where his office will be located.

The Experiment Station Record reports that at the Michigan College and Station, following action by the legislature reducing state appropriations to $1,000,000 per annum for the current biennium, or 28 per cent. less than for the previous biennium, reductions of $500,000 have been made by the State Board of Agriculture. These included further salary cuts of 4 to 18 per cent. on salaries over $1,000 and a reduction of 22.1 per cent. in maintenance expense. At the New Jersey Stations, following recent drastic reductions in the state appropriations, a supplemental appropriation of $83,000 was granted to the university, a part of which will be allocated to the College of Agriculture.

THE *Journal* of the American Medical Association reports that ten million dollars will be expended in the federal program of malaria control to be launched by the U. S. Public Health Service. The work will be carried on in twelve states: Florida, Arkansas, Alabama, Louisiana, the southeastern portion of Missouri, Mississippi, North Carolina, South Carolina, Georgia, Tennessee, Texas and Virginia. Dr. Thomas H. D. Griffitts, who has been conducting a preliminary survey in Florida for the past year, will supervise the campaign, which is planned to begin in the counties of western Florida. The plan, approved by the Federal Emergency Relief Administration, provides that, while the public health service will cooperate in technical direction and will detail medical and engineering officers for duty in the states, each state department of health is ultimately to assume direction of the work. Surveys conducted by Dr. Griffitts in eight of the most heavily infected counties in Florida reveal that more than 5 per cent. of the 10,000 school children examined have shown malarial infection, this number not including those who were actually suffering from acute attacks of malarial fever.

THE report of the Executive Committee presented on October 28 to the Council of the Association of

Scientific Workers, according to *Nature,* is a document containing a record of sustained and useful work. The outstanding event of the last half-year has been the formation in conjunction with the British Science Guild of the Parliamentary Science Committee. The association has also taken an active part with other scientific bodies in the endeavor to save the Research Association of British Rubber Manufacturers from disintegration. To that endeavor has been added an inquiry as to the best means of stabilizing the finances of the industrial research associations generally. In this connection, the association has joined with the British Science Guild in the appointment of a joint committee; and when the labors of that body are completed it is probable that it will report to the Parliamentary Science Committee with a view to taking action. During the period under review, the University Degrees Bill, promoted by the association, has received its second reading in the House of Lords without division; but it is not likely to reach the Statute Book before the session closes. A publication of which the association may well be proud, it is pointed out, is "Science in Parliament," a summary of all affairs relating to science dealt with in Parliament. Another achievement has been the establishment of a publicity bureau.

DISCUSSION

WIDE-SPREAD ERRORS RELATING TO LAPLACE

P. S. LAPLACE (1749–1827) is one of the most widely and most favorably known names in the literature of the exact sciences, especially in astronomy and mathematics. Hence one might have expected that it would be easy to find accurate biographical sketches of him in the histories of these subjects as well as in the general encyclopedias. On the contrary, these sketches usually contain much that is certainly incorrect as well as various statements that can now be neither verified nor disproved in view of the fact that many of the documents relating to him were destroyed by fire. Karl Pearson and G. A. Simon described these conditions in details in volume 21 (1929), *Biometrika,* where the former used the following striking sentence: "At least, our friends, the little historians, might have taken the trouble to inquire whether there was a 'military school' in Beaumont-en-Auge before the year 1771 when Laplace left home for Paris, they might have ascertained the position of Laplace's father, and taken the pains to find out whether Poisson's statement that Laplace was educated at the University of Caen was or was not correct."

It seems now well established that the common statement that P. S. Laplace was born in poverty is fictitious and hence there is no foundation for the assertion that our ignorance of his early life is due to a false shame on his part of springing from humble parentage. He seems to have enjoyed good educational advantages from early childhood and to have been related both on the side of his mother and on the side of his father to prominent members of the community in which they lived. It is, however, less important to dispel false statements relating to the supposed lack of his early cultural advantages than to dispel the unfounded derogatory statements relating to his character. He achieved not only great scientific distinction but also eminent political positions. In particular, Napoleon appointed him as Minister of the Interior, but replaced him six weeks later by his own brother, Lucien Buonaparte. In his *Mémoires de Sainte Hélène* Napoleon described this incident as follows: "Mathematician of the highest rank, Laplace was not long in showing himself an extremely poor administrator. From his first actions I realized that I had deceived myself. He sought everywhere for subtleties, had only problematic ideas, and carried the spirit of the 'infinitely small' into administration."

This quotation proves only that Laplace was not the kind of administrator that Napoleon wanted in that position at that time. The fact that his own government was overthrown later shows that he himself was not always the kind of administrator that the people of France wanted. Since politics is not an exact science the ideas relating thereto are necessarily problematic. The fact that France has continued to the present time to put eminent mathematicians into high administrative positions implies that she has not lost sight of the fact that high mathematical attainments do not necessarily imply a lack of administrative ability. The fact that Laplace was greatly honored by successive governments with different policies does not imply, as some historians assert, that he sought political favors at the expense of following his convictions as regards political questions. In a country where high scientific attainments are widely appreciated the governments naturally seek the support of those who have such attainments.

P. S. Laplace seldom, if ever, expressed in his writings any political opinions of his own, but in his widely read "History of Mathematics" W. R. Ball said that "the skill and rapidity with which he man-

aged to change his politics as occasion required would be amusing if they had not been so servile. As Napoleon's power increased Laplace abandoned his republican principles (which had themselves gone through numerous changes, since they had faithfully reflected the opinions of the party in power) and begged the First Consul to give him the post of minister of the interior." This quotation appears not only in various editions of this history but also in the French translation thereof and is probably responsible for many of the misleading remarks which appear in the brief biographical sketches. Possibly the articles cited in the first paragraph of this note will receive sufficient publicity not only to remove certain moral blemishes from the biographies of one of the most eminent scientists but also to create greater caution as regards the acceptance of derogatory remarks made by popular historical writers who fail to give references in support thereof.

G. A. MILLER

UNIVERSITY OF ILLINOIS

PROPAGATION OF HYBRID AMARYLLIS (HIPPEASTRUM) BY CUTTAGE

SOME experimental results concerning cuttage in relation to the physiology of reproduction in the Amarylleae Genuinae and Pancratiae are worthy of brief mention, since the subject has apparently received little attention.

The Nehrling-Mead strain of Hybrid Amaryllis (Hippeastrum) was used in the initial experiments. In the breeding of this strain, *H. reginae, H. equestre, H. aulicum, H. psittacinum, H. pardinum, H. solandriflorum, H. leopoldi* and possibly also *H. reticulatum* were apparently utilized.[1] Blooming size bulbs were cut (1) lengthwise into quarters as far as the middle of the root base, and (2) into quarters. A variation was introduced in each of the two types, consisting of cutting off a little less than half of the top of the bulb before making the lengthwise cuts.

The two "callusing-sprouting" media used were sand and loam. The partially quartered bulbs and the quarters were planted in these media contained in clay pots. Moderate water was applied until growth had definitely started. Any flower buds already formed in the fractions expanded and flowered, and leaf growth appeared above the surface in some cases in less than 30 days. In three months the original ten bulbs had given rise to 15 new bulbs, an increase of 50 per cent. In another month the number of new bulbs had increased to 43, an increase of 330 per cent.

On inspection it was noticed that new bulbs had been formed at the leaf axes. The roots, however, issued from the root base fraction of the mother bulb. Roots were more abundant and longer in case of partial quartering. Complete severing apparently retards root formation. The partially quartered bulbs had entirely or practically broken into quarters by the pressure of the developing new bulbs. Where still slight connections were present, these were broken at transplanting time. The sand "callusing-sprouting" medium gave disease-free plants, as contrasted with some red rust on plants propagated in loam.

The work is being extended to include a study of the maximum number of new bulbs obtainable from one bulb, the time required for new bulbs to reach blooming size, the best season to carry out the operation and also the application of this principle to the propagation of other types of Amarylleae such as *Crinum, Hymenocallis, Vallota, Lycoris,* etc. A more detailed report will appear in the 1934 Year-book of the American Amaryllis Society.

HAMILTON P. TRAUB

ORLANDO, FLA.

SUGGESTED NOMENCLATURE FOR HEAVY HYDROGEN AND ITS COMPOUNDS

THERE seems to be some difficulty in securing a suitable term by which to designate heavy hydrogen and its compounds. The selection of "deuterium" seems only to complicate the matter, for it rather suggests a new element instead of an isotope. It seems to me that the situation could be met by *speaking* of heavy hydrogen as bar-hydrogen; writing the word, however, $\overline{\text{H}}$ydrogen. Compounds made of this substance could be *called* bar-benzol and written $\overline{\text{B}}$enzol bar-ammonia, written $\overline{\text{A}}$mmonia, and so on. In formulae for compounds the H atoms of heavy hydrogen could be designated by the dash.

R. W. WOOD

THE JOHNS HOPKINS UNIVERSITY

SPECIAL CORRESPONDENCE

HEALTH PROBLEMS IN THE AMAZON VALLEY

THE letter from Earl Hanson[1] interested me, since I am at present working in health problems in the Amazon Valley. In the Hospital of Cia. Ford Industrial do Brasil, located at Boa Vista, Rio Tapajoz, we are only 140 miles south of the equator and in the heart of Amazonian jungle. Here we have seen many thousand natives of the region. These are not

[1] H. Nehrling, "Die Amaryllis oder Rittersterne (Hippeastrum)." Paul Parey, Berlin, 1909.

[1] SCIENCE, 78: 2011; 36–38, July 14, 1933.

confined to a small area because, since our hospital is the only one within several hundred miles, we receive patients from as far east as the Xingu River, as far south as Matto Grosso and as far northwest as Manaos. The following observations are my own and are the result of working for the past 14 months with these natives.

The average native of the Amazon Valley is afflicted with what I have called the Amazonian Pentad. That is, he has five major disabilities, which in varying degree cause him to have, as Mr. Hansen has said "universal lethargy." These are in differing degrees of importance: (1) Chronic malaria; (2) verminosis; (3) secondary anemia; (4) malnutrition; (5) splenomegaly.

(1) *Chronic malaria:* From various surveys of riverside villages, inspection of laborers for company employment and routine blood examinations in the hospital we are able to state that from 50 to 75 per cent. of the natives of this region have chronic malaria. This is about the ratio of 6 to 7 *P. vivax* infections to one of *P. falciparum*. *P. malariae* is very rare. This is the average in unprotected communities—that is, villages in which no public health work is done. In the company village the rate is less than half the above. Since it is generally agreed that if it is possible to find from 30 per cent. to 35 per cent. positive smears in any given survey, one can predict 100 per cent. infection, we feel that it is safe to state that the great majority of natives have chronic malaria.

(2) *Verminosis:* In 6,384 stool examinations in the hospital laboratory the past three and one half years but 655 negatives have been recorded. These are usually single examinations, and it is safe to say that repeated searches would reduce the number of negatives very considerably. Of the positive stools many are multiple infestations. Ankylostoma is the most frequent invader, with trichuris next and ascaris third.

(3) *Secondary anemia:* The figures in the preceding table are taken from our laboratory records and show the extent of the anemia registered here. From these figures it will be seen that more than 90 per cent. of the examinations show a more or less well-marked diminution in hemoglobin.

HEMOGLOBIN (Tallquist)

	Number of examinations	Per cent.
Below 20 per cent.	10	0.136
Between 20 per cent. and 30 per cent.	42	0.573
" 30 " " " 40 " "	71	0.96
" 40 " " " 50 " "	519	7.07
" 50 " " " 60 " "	5,620	76.59
" 60 " " " 70 " "	874	11.93
" 70 " " " 80 " "	112	1.52
" 80 " " " 90 " "	41	0.55
" 90 " " " 100 " "	18	0.21
Over 100 " "	17	0.20
	7,324	

RED BLOOD CELLS

	Number of examinations	Per cent.
Below 1,000,000	11	0.176
Between 1,000,000 and 1,500,000	35	0.56
" 1,500,000 " 2,000,000	59	0.94
" 2,000,000 " 2,500,000	71	1.13
" 2,500,000 " 3,000,000	133	2.12
" 3,000,000 " 3,500,000	2,172	34.75
" 3,500,000 " 4,000,000	2,981	47.51
" 4,000,000 " 4,500,000	555	8.88
" 4,500,000 " 5,000,000	199	3.18
Over 5,000,000	34	0.55
	6,250	

These figures show almost 90 per cent. more or less marked anemia.

(4) *Malnutrition:* The average diet of the native consists of fish, salt or dried meat and *farinha,* together with a certain amount of fruit. Vegetables do not play a large part in the plan of eating. It is my impression that while the diet lacks much of being ideally balanced, the chief difficulty is not this so much as a less than normal quantity. The natives are for the most part miserably poor and unable to purchase enough for adequate maintenance. In Boa Vista company employees eat much the above diet, except that they are urged to eat as many fruits and vegetables as possible. It is somewhat of a task to persuade them to add these articles to their diet, but in spite of this such company employees and their families are much better nourished.

(5) *Splenomegaly:* It is not possible to say at this time whether Amazonian or tropical splenomegaly is an independent disease, or related to chronic malaria and verminosis. My impression is that it is chiefly due to repeated attacks of malaria. A large percentage of the natives have chronically enlarged spleens. In 60 autopsies done in the past 14 months, but one showed a normal spleen. This man was an adult male who claimed that he had never had malaria. The average weight of a native spleen at

autopsy is 500 gms, with many running as high as 700 to 750 gms.

The point I wish to make, then, is that the lethargy, the shiftless attitude and general lack of well-being of the people of the Amazon Valley can not be blamed on any one condition. Where adequate mosquito control and adequate quinine are available, where vermifuges are freely and frequently given, and where the native has money with which to purchase adequate food, his physical status becomes remarkably better. Dr. Colin Beaton and myself have papers in preparation which will enlarge on the points made here.

ROBERT J. NEEDLES

CAIXA POSTAL, 68
BELEM, PARA, BRAZIL

SCIENTIFIC BOOKS

THE LIFE AND WORK OF PROFESSOR WILLIAM HENRY PERKIN[1]

THE gods are not always kind to parents, but British parents are on their preferred list. The Darwins, the Huxleys, the Haldanes are familiar to all of us. And now to this list must be added the Perkins. Perkin, the founder of the coal-tar industry, was the proud father of three well-known chemists; and one, in particular, the subject of this memoir, became the leading organic chemist of his day in England. The boy started badly. He "flunked" the London matriculation examination, largely because of his dislike for Latin and Greek. But when he did enter the Royal College of Chemistry in 1877 (at the age of 17) he showed sufficient manipulative skill in the laboratory to attract the attention of the professor, Edward Frankland. In those days in England (and in America), however, to be a chemist without the background of a German university training was to be no chemist at all; and despite some religious scruples (for the elder Perkin was a God-fearing man and looked with some disfavor upon the semi-atheistic views promulgated by some of the German *professoren*), the young Perkin was sent to Würzburg to study organic chemistry under Wislecenus, a great investigator and a greater teacher. In 1882 Perkin received his Ph.D. for an investigation dealing with the action of alkali on oenanthaldehyde.

That same year he transferred to Munich, to study further under the king of organic chemists, Baeyer. At this time Otto Fischer, Königs, Friedlander and Curtius were in Munich for the same purpose. It was here that he did his work on ethyl benzoylacetate, the analogue of ethyl acetoacetate—a work which earned him the title of *Privatdozent*. It was here also that he started work on three-, four-, five-, six- and seven-membered carbon rings—at the time a task of no mean proportions, seeing that even men like Victor Meyer, Emil Fischer and Baeyer himself were of the opinion that only six- and at best five-membered rings were possible. Perkin's success led Baeyer to develop his "Spannungs Theorie," which associates the extent of stability of a cyclic structure with the strain set up in the molecule by the alteration of the value of the tetrahedral angle necessary to form a ring.

After six years in Germany, Perkin returned to England and in 1887 was appointed professor of chemistry at the Heriot-Watt College, Edinburgh, with Kipping for his demonstrator. Here he entered the field of alkaloid chemistry by investigating the constitution of berberine. In 1892 he was appointed professor of organic chemistry at Owen's College, now the Manchester University; and here he remained active for the next twenty years. It was during these years that he contributed to the chemistry of camphor, only to be forestalled, to some extent, by Komppa. He was also busy with a study of terpenes, those derivatives of *cyclo*-hexane containing unsaturated linkages. Many synthetic terpenes were prepared by him from various keto-acids with the aid of the Grignard reagent. The dye-wood products, brazilin, $C_{16}H_{14}O_5$, and hematoxylin, $C_{16}H_{14}O_6$ (the latter a hydroxy-derivative of the former), carbon ring compounds and various alkaloids formed further objects of study. Together with Kipping, Perkin published his well-known organic text-book in 1894, and a somewhat corresponding inorganic text in 1909.

In 1912 Perkin was appointed to a chair of chemistry at Oxford. Such was the state of the sciences at that great institute of learning that for a time Perkin remained the one and only professor of chemistry at Oxford! Later, Soddy and others joined him. At Oxford he supervised the building of a new chemical laboratory, known as the Dyson Perrin's laboratory, which is considered to be one of the best equipped of its kind in all England. Its present director, Professor R. Robinson, the great authority on plant pigments, has made this laboratory known to all students of organic chemistry.

Perkin died in 1929.

A list of Perkin's collaborators, assistants and students is a list of English chemists of the very first rank. Among them we have A. G. Perkin, Kipping, Haworth, Bone, J. F. Thorpe, Weizmann, R. Robinson, Pope and Sedgwick.

BENJAMIN HARROW

[1] Published by the Chemical Society, Burlington House, London, 1932.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE SENSITIVE THERMOSTAT REGULATOR

Two excellent precision thermostats for liquid baths have recently been described.[1,2] Both of these thermostats, unfortunately, are rather expensive and difficult to make. The instrument here described is simple, inexpensive, sensitive, easily adjustable, and can be made by any one with even a limited knowledge of glass blowing. The sensitivity of the thermostat is at least ± 0.001° C. in the 0° to 35° C. range for relatively long periods of time. For this range petroleum ether (benzine, B. P. 40° to 60° C.) is the activating medium. There is also available another benzine with a boiling-point of 68° to 70° C. which would considerably extend the working range, but since the author has not needed to use temperatures above 30° C. he has not tried the higher boiling-point benzine and has no information as to its relative activity. With the benzine used there is an exceedingly rapid response to very slight temperature changes and there is an expansion of about 2 inches in a 1-mm capillary tube for each Centigrade degree. Temperature regulation is therefore possible with ease and precision and high sensitivity is obtained. Changes in atmospheric pressure, as noted by Ferguson *et al.*,[2] affect the temperature readings, but they can be easily controlled by the method suggested by those authors. A slight improvement in their method is here suggested.

The details of construction are readily seen in the accompanying sketch (Fig. 1). Expansion bulb A is made of 18 inches of 12-mm thin-walled glass tubing and is fused to about 15 inches of 4-mm medium-walled tubing, bent as indicated in the sketch. The top of the U-bend should be, at all times, below the surface of the liquid of the bath in which the thermostat is used. To this tube is fused a bulb, B, for mercury, made of about 1 inch of 12-mm tubing, or large enough to accommodate all the mercury that is shifted by changes in temperature for the complete range of the thermostat. To the lower end of this bulb is fused another piece of 4-mm tubing, C, bent to form a U-tube to which can be fused the thermostat head, H. This U-tube is an essential part of the thermostat, as it compensates for the weight of

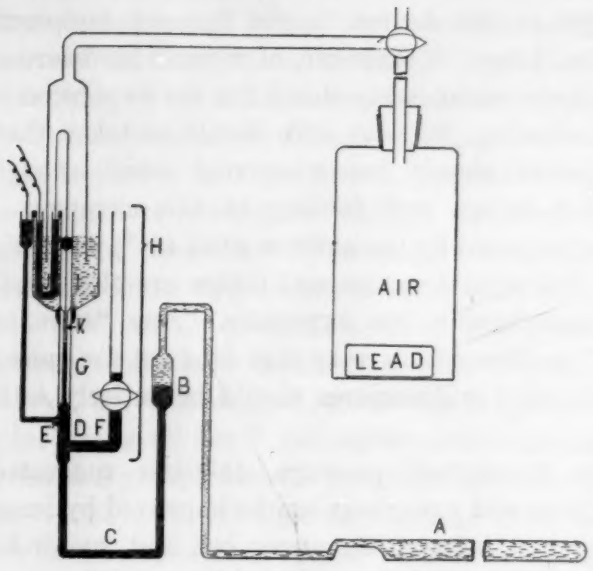


FIG. 1. Thermostat regulator.

the mercury and prevents the mercury from passing into and mixing with the petroleum ether. The thermostat head, H, consists of a 2-inch piece of 7-mm tubing, D, through which is fused a piece of platinum wire, E; a stopcock side arm, F, which has been bent upward; and a 2-inch length of 6-mm, 1-mm bore[3] capillary tubing, G. To the upper end of the capillary tube is fused 2¼ inches of 7-mm tubing, I. The junction of G and I should be on the same level as the top of the U-bend above B, so that the entire sensitive portion of the regulator is submerged in the bath. Around the junction of G and I there is fastened, either by fusing or with red sealing wax, an inverted bell of 30-mm tubing to act as a water seal for the atmospheric-pressure stabilizer. A 2-inch U-tube, J, filled with mercury, is fastened to the bell and to the top of tube I to aid in making an electrical contact. Fastened over the platinum wire E and to the outside of the bell is a capillary tube drawn from a piece of 7-mm tubing, with the unconstricted portion at the top. This tube is also filled with mercury and makes the second electrical contact.

Before use the thermostat regulator is completely filled with petroleum ether. Then mercury is introduced through the ether and tapped around the U-bend so as partially to fill the mercury bulb, B. After all the ether above the mercury has been dried out, a piece of copper wire to one end of which has been fused a piece of platinum wire, K, is introduced into tube I. This wire is provided with a collar 2¼ inches above the platinum tip of such size as to produce friction in tube I. The other end of the copper wire is bent into a 2-inch U-bend so that the wire will extend down inside of tube J to complete

[1] James A. Beattie, "A Precision Thermostat for Temperatures from – 25° to 500° C." *Rev. Sci. Instruments* 2 (8): 458–465, 5 figs.; also in Publ. Mass. Inst. Tech., 67 (42) 1931.

[2] Alfred L. Ferguson, Kenneth Van Lente and Richard Hitchens, "High-precision Constant-temperature Bath." *Ind. Eng. Chem.*, Anal. Ed., 4: 218–219, 4 figs. 1932.

[3] There has been no difficulty with sticking when tube of this bore has been used.

the electrical circuit. By opening and closing the stopcock in tube F the mercury in tube G can be brought to the desired height for any temperature. A tube, 1 inch in diameter, of 4-mesh hardware cloth provides a satisfactory shield for the expansion bulb.

In selecting the relay care should be taken that the thermostat circuit has a current small enough to prevent arcing and fouling of the mercury. The types proposed by the authors cited ([1, 2]) are satisfactory, but several commercial makes are also good and are considerably less expensive. Any "super-sensitive," positive-action relay that does not use more than 3 volts at 4 milliamperes should be entirely satisfactory.

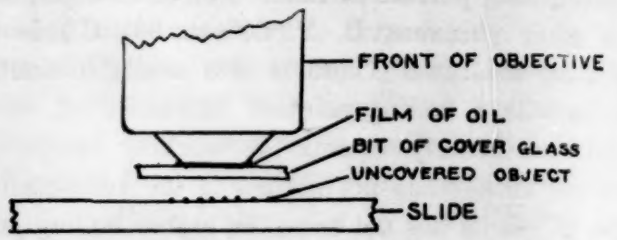
The atmospheric-pressure stabilizer suggested by Ferguson and coworkers can be improved by inserting a stop-cock between the upper bell and the air bottle. This enables one to set the apparatus for a given temperature at any atmospheric pressure, to place the upper bell in the water seal without changing the pressure, and then by closing the stop-cock to maintain this pressure except for variations due to temperature on the portions of the glass above the bath. Another suggestion is to place some lead in the air bottle and submerge it in the water bath so as to reduce these temperature effects to a minimum.

CHAS. E. WOODWORTH
U. S. BUREAU OF ENTOMOLOGY

USING A "DRY" MICROSCOPE OBJECTIVE ON UNCOVERED OBJECTS

THE usual type of high power "dry" microscope objective is not satisfactory for use on uncovered objects, as its optical combination is calculated on the assumption that a cover-glass of definite thickness intervenes between the front lens and the object. Such objectives would often be convenient for use on uncovered objects, such as blood smears, small parts of insects, etc., and can be adapted to such use by a simple expedient.

All that is required for the proper working of the objective is the presence of the cover-glass between



the front lens and the object; either on the object, on the front lens or at any point between. Hence, if a bit of cover-glass is fastened over the front lens, the objective will give good images of uncovered objects. The piece of cover-glass may be made to adhere temporarily with a drop of cedar oil, mineral oil or water.

F. C. SAUER
UNIVERSITY OF WICHITA

SPECIAL ARTICLES

THE INTERNAL EXPOSED SURFACE OF FOLIAGE LEAVES

THERE has been increasing realization of the importance of the internally exposed surface of foliage leaves. Much of the water lost and most of the carbon dioxide absorbed by leaves must pass through the cellulose walls bordering on connected intercellular spaces. The rates of leaf functions have often been expressed in terms of external surface but a knowledge of the extent of the internally exposed areas bordering on the intercellular spaces is important and without such information comparisons based on superficial area may not be significant.

Irregularity in the form of mesophyll cells has been probably the greatest barrier to such measurements. The writer has developed a method based on careful camera lucida drawings of the several cell layers in both vertical and horizontal sections; measurements of these drawings were then made with chartometer and planimeter. Formulae were derived to facilitate computation of the ratio between the internally exposed cell wall and the externally exposed surface of selected samples which were free from veins.

Ratios for a few species appear in the following table.

Leaf	Type	Exposure	Thickness	Ratio
Syringa vulgaris	Mesomorphic	Sun	228 μ	13.2
Vitis vulpina	Mesomorphic	Sun	163 μ	11.6
Citrus limonia	Xeromorphic	Sun	238 μ	22.2
Berberis nervosa	Xeromorphic	Shade	254 μ	9.8
Bryophyllum Calicynum	Succulent	Greenhouse	610 μ	7.8

The method, which is too elaborate for description here, involves many measurements of a number of items, averages being used in the formulae. Though many measurements enter into the computation for a given species, differences in the internal organization of leaves even on the same tree indicate that the ratio in a given case should be considered as a mean about which variation must be expected.

Preliminary results, which include other species in addition to those noted above, indicate: (1) that succulents may have a relatively small internal surface ($R = 7.86$); (2) mesomorphic sun leaves though thin

may have a relatively large internal surface ($R = 11.6$ to 16.3); (3) xeromorphic leaves of sun species may have a very extensive internal surface ($R = 22.2$ to 31.3); while (4) xeromorphic leaves of shade species may have a limited internal surface ($R = 8.18$ to 9.88).

Although present data do not warrant final conclusions, the frequent references to the correlation between xeromorphic structure and high transpiration rate may be explained by the high ratio of internal surface in xeromorphic leaves as noted above. The extensive internal surface of such forms is due primarily to the palisade type of mesophyll, commonly found in sun leaves of this type.

The photosynthetic rate likewise seems to be correlated with the area of the internally exposed surface. With this function, however, the importance of the internally exposed area may be somewhat enhanced by the properties of cellulose itself. A more complete account of methods with formulae, data and discussion will be published soon.

FRANKLIN M. TURRELL

UNIVERSITY OF IOWA

PREDOMINANT STRAIN OF B. INFLUENZAE IN INFLUENZAL MENINGITIS[1]

IN contrast to the multiplicity of strains of *B. influenzae* derived from the respiratory tract and other sources, over 50 per cent. of the strains of influenzal meningitis fall into one group. In the original work of 1921 the author found that 4 out of the 7 strains of *B. influenzae* from influenzal meningitis in her possession fell into one group, while the other 3 seemed to be all different. Rivers obtained our 7 cultures and 6 more from outside, and though he differed from us in the grouping of our cultures, stated that he has been able to confirm and extend our results showing the existence of definite groups embracing the majority of the available strains of influenzae bacilli isolated from cases of meningitis. We continued our studies with the predominating type exclusively up to date and find that the ratio of about 50 per cent. of *B. influenzae* from influenzal meningitis fall into this predominating type (our type I). We did not attempt to group the other half. For practical purposes, however, it was reasoned that a serum which can embrace 50 per cent. of the encountered strains and more of the closely related ones is the best we can have at present until something better is discovered. Our horses are immunized accordingly with formalyzed cultures of this predominating type, to which one heterogenous strain is added. The question of standardization of these sera is as unsatisfactory as in case of antimeningococcic sera. We use agglutination and precipitin tests.

Pittman demonstrated in her studies of hemophilus influenza two kinds of strains S and R (smooth and rough colonies). They differ from each other morphologically and serologically. The S strains are stated to contain capsules and produce a specific soluble substance which is present in culture filtrates and washings of the bacteria. By means of cross precipitation and direct agglutination reactions she has been able to divide 15 S strains—7 of which were isolated from influenzal meningitis, into 2 groups A and B. All seven meningeal strains fell in group B. By this technique all her 7 meningeal strains seemed to comprise one group, whereas by agglutinin *absorption* test we have found that our strains (58) are alike only in 50 per cent. of cases. The same author also states that the S strains are easily converted into R. Because of the permanency of the serologic types, under ordinary conditions it seems to the writer that before anything better is discovered the grouping of *B. influenzae* by agglutinin absorption is by far a more sensitive and reliable test than any other suggested. Direct agglutination is not enough. We encountered many a strain which would be agglutinated by a serum even in a higher titer than its hemologous strain, to find that by absorption it was only either closely related or entirely a heterogenous strain stimulating the production of only common agglutinins.

Since 1922 the writer has received from Dr. Josephine Neal 84 cultures of *B. influenzae* from meningeal influenza; 1922, 13 cultures, 1923, 6 cultures, 1924, 5 cultures, 1926, 6 cultures, 1927, 3 cultures, 1928, 6 cultures, 1929, 6 cultures, 1930, 4 cultures, 1931, 14 cultures, 1932, 12 cultures and 1933, 9 cultures.

Grouping with the serum of the predominant strain by agglutinin absorption test was performed with 58 strains with the following results:

Identical with the predominant strain	27
Closely related to the predominant strain	18
Heterogenous	13
	58

Conclusion: The finding of a dominant type of *B. influenzae* in influenzal meningitis may hold some hope for developing an effective serum for treatment of this fatal infection.

OLGA R. POVITZKY

SELECTIVE FERTILIZATION AND SEX-DETERMINATION IN HYMENOPTERA

THE problem of sex-determination in the bee and in other forms in which males develop by haploid

[1] From the Research Laboratories, Department of Health, New York City.

parthenogenesis, females from fertilized eggs, has been "the outstanding unsolved puzzle, although before the development of the idea of genic balance it seemed one of the clearest and simplest of cases."[1] Neither genetic nor cytologic work has hitherto been able to solve the problem, although demonstration of the diploid nature of biparental males of Habrobracon[2] made it clear that the explanation was not to be sought in chromosome number.

On the basis of study of feminization of genitalia in mosaic males of Habrobracon, the suggestion was made that there are two kinds of haploid male tissue (X + A and Y + A) and correspondingly two different types of haploid males differing in sex-determining factors. The X-chromosome contained one or more dominant factors and one or more recessives (F.g), while the Y contained the allelomorphs (f.G). It was postulated that the female was the double dominant (1X + 1Y + 2A) and was digametic, producing from unfertilized eggs the two types of haploid males. Fertilization of eggs would give rise to females or to biparental males, the latter being 2X + 2A or 2Y + 2A, according to the type of sperm entering the egg. Such a hypothesis is consistent with the principle of genic balance.

All fertilized eggs from one mating would be entered by the same type of sperm, X + A, for example, but there would be two kinds of reduced egg nuclei present, X + A and Y + A. It might then be expected that homoeosyngamy, fusion of X + A with X + A, would be as frequent as heterosyngamy, fusion of X + A with Y + A. Extensive studies on ratios of males among biparentals and of biparentals among total offspring, as well as correlated investigations of egg hatchability indicate that selective syngamy takes place: the sperm nucleus uniting with the unlike egg nucleus to produce a female. Heterosyngamy always occurs when parents are unrelated, for all biparentals from such crosses are females. If parents are related, however, a few biparental males appear because of occasional homoeosyngamy. Frequency of males among biparentals, varying according to genetic constitution of stocks and temperatural conditions, is inversely correlated with ratio of total biparental offspring (males and females) and with hatchability of fertilized eggs. Thus it appears that fusion of like gametes has a lethal effect, but that a few combinations are viable, resulting in diploid males.

The theory, which was tentatively advanced a short time ago,[3] needed confirmation such as might be obtained from a sex-linked trait. A number of linkage groups were therefore tested by back-crossing heterozygous females to their recessive father. Dominant and recessive F_2 males should appear in equal numbers, except for viability differences, but in case of complete sex-linkage there should be no recessive females. If there were crossing-over between the sex-determining region and the gene in question a minority of the recessive females should be found varying according to the strength of the linkage. Another recessive male crossed with the F_1 heterozygous females should, if he were like the father (X + A for example), sire a minority of recessives, but if he were of the opposite type (Y + A) the recessive daughters should be in corresponding majority.

Dominant and recessive females have appeared in approximately equal numbers for several genes tested, but for fused (affecting antennae, tarsi and wings) the recessives were in decided minority among the females resulting from the back-cross, although their fused brothers appeared in expected numbers. Different fused males have been crossed to heterozygous females from the same fraternity. Some males give a marked excess of wild-type daughters while others give a marked excess of fused. No one male produces the two different types of fraternities by different heterozygous females belonging to the same fraternity. Wild-type crossovers average 8.7 per cent., while fused crossovers average 3.8 per cent., a difference expected on account of viability.

It was to be expected that sex-linkage would be incomplete, since all linkage groups thus far found have shown crossing-over. Two other genes have been found loosely linked with fused. These are being tested for sex-linkage.

P. W. WHITING
CARNEGIE INSTITUTION OF WASHINGTON
COLD SPRING HARBOR, N. Y.

[1] C. B. Bridges, *Amer. Nat.*, 59: 134, 1925.
[2] Magnhild M. Torvik, *Proc.* Penna. Acad. Sci., 7: 119, 1933.
[3] P. W. Whiting, *The Collecting Net,* Woods Hole, 8: 11, and *Biol. Bull.*, 65: 357, 1933.

BOOKS RECEIVED

Aristotelian Society. *Proceedings.* Vol. XXXIII. Pp. 354. Harrison and Sons. 25s.

Bureau of American Ethnology, Forty-eighth Annual Report. 1930–1931. Pp. 1220. Smithsonian Institution.

CAULLERY, MAURICE. *La Science Française depuis le XVIII siècle.* Pp. 214. Librairie Armand Colin.

HARANT, HERVE et PAULETTE VERNERIES. *Faune de France.* Pp. 99. 94 figures. Le Chevalier.

Index Veterinarius, 1933. Vol. 1, No. 1. Pp. xxxvi + 304. Imperial Bureau of Animal Health, Weybridge, Surrey, England.

MACGINITIE, HARRY D. *The Trout Creek Flora of Southeastern Oregon.* Pp. 48. 16 plates. Carnegie Institution.

RICARD, R. *La Conquête Spirituelle du Mexique.* Travaux et Memoires de l'Institut d'Ethnologie, Vol. XX. Pp. xix + 404. 22 plates. Institut d'Ethnologie. 125 fr.

ROYS, RALPH L. *The Book of Chilam Balam of Chumayel.* Pp. viii + 229. 2 plates, 48 figures. Carnegie Institution.